HONDA
Honda R&D Americas, Inc.

Standardizing on ASAM ODS for Managing Test Data at Honda R&D Americas Inc.

Jay Gundavelli
Sr. Systems Engineer, Information Systems – CAT&MBSE

Honda R&D Americas, Inc.

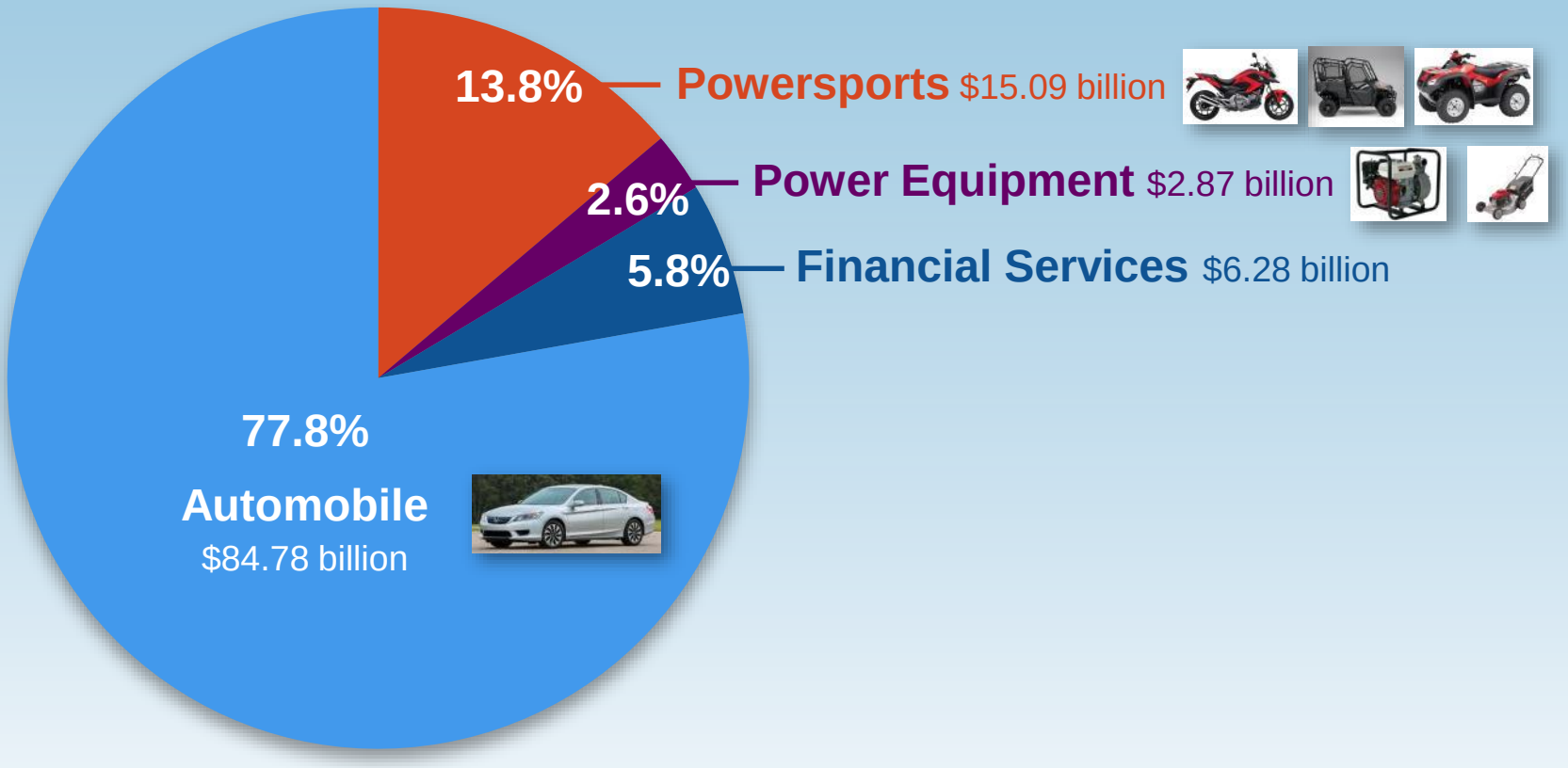
Presentation Flow

1. Honda N.A. Background Information
2. Test Data Management Standardization at Honda R&D
3. Future

Revenue by Business Segment CY 2013

HONDA

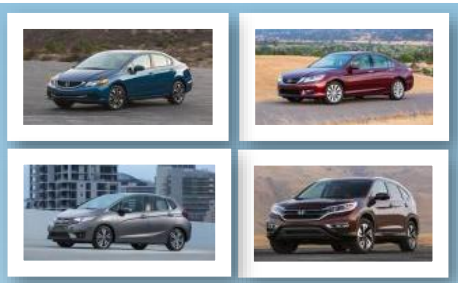
Global revenue generated in 2013 totaled $109 billion



Note: For report, JPY 105.39 = U.S. $1, the average of the telegraphic transfer selling exchange rate and the telegraphic transfer buying exchange rate prevailing on the Tokyo foreign exchange market on Dec. 31, 2013.

Honda Automobile Sales CY 2013

HONDA



4.3 Million Units Sold Worldwide

China
Honda Motor (China) Investment Co., Ltd.
764,000 units

North America
American Honda Motor Co., Inc.
1,764,000 units

Europe/Africa/Middle East
Honda Motor Europe Ltd.
253,000 units

Japan
Honda Motor Co., Ltd.
763,000 units

Asia & Oceania
Asian Honda Motor Co., Ltd.
573,000 units

South America
Honda South America LTDA
160,000 units

Honda in North America

Products and Production

HONDA

Honda of Indiana

Acura ILX | Civic Sedan | Civic Natural Gas

Honda Power Equipment

Lawnmowers | Engines

Honda Aero/Aircraft Co.

Jet Engines | HondaJet

Honda of Canada

CR-V | Civic Coupe | Civic Sedan | L-4 Engines

Honda of America

Acura RDX | Acura TL | CR-V | 4cyl. & V6 Engines | Crosstour | Accord Coupe | Accord Sedan

Honda de Mexico

CR-V | 4cyl. Engines | Beat 100

Honda of South Carolina

Foreman | Rancher | Pioneer

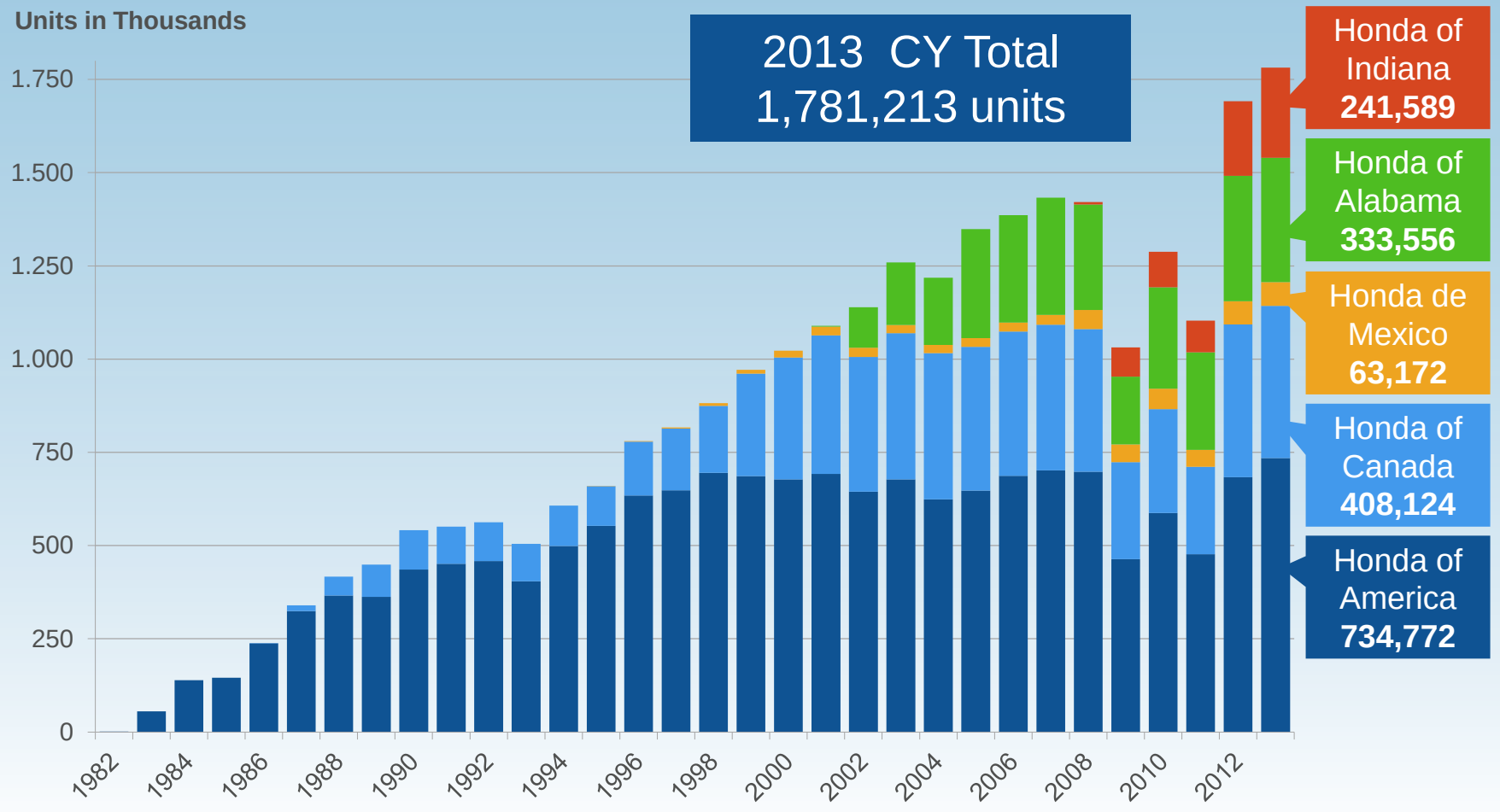
Honda of Alabama

Pilot | Odyssey | V6 Engines | Ridgeline | Acura MDX

North American Auto Production History

HONDA

Auto production facilities have combined to produce more than 26.8 million automobiles since 1982



Honda in North America

North American Locations

HONDA

American Honda Motor Co., Inc. (1959)
- Sales & Distribution
- Torrance, California; Duluth, Georgia

Honda Canada, Inc. (1969)
- Sales & Distribution
- Scarborough, Ontario

Honda Trading America Corporation (1972)
- Torrance, California; Marysville, Ohio;
- Lincoln, Alabama & Timmonsville, S.C.

Honda R&D Americas, Inc. (1975)
- California, Florida, North Carolina, Ohio

Honda of America Mfg., Inc. (1979)
- Automobile and Engine Production
- Anna, East Liberty, & Marysville, Ohio

Honda Power Equipment Mfg., Inc. (1984)
- Power Equipment and Engine Production
- Swepsonville, North Carolina

Honda de Mexico, S.A. de C.V. (1985)
- Automobile, Motorcycle & Parts Production
- El Salto, Estado de Jalisco, Mexico

Honda of Canada Mfg. (1986)
- Automobile and Engine Production
- Alliston, Ontario

Honda North America, Inc. (1987)
- California, Georgia, Michigan, New York, Ohio, Washington, D.C.

Honda Engineering North America, Inc. (1988)
- Alabama, Indiana, Ohio, Ontario

Honda Transmission Mfg., Inc. (1997)
- Automatic Transmissions, 4-Wheel Drive Systems
- Russells Point, Ohio

Honda of South Carolina Mfg., Inc. (1998)
- ATV and Engine Production
- Timmonsville, South Carolina

Honda Manufacturing of Alabama, LLC (2001)
- Minivan, SUV, Light-Truck and Engine Production
- Lincoln, Alabama

Honda Aero, Inc. (2004)
- Aviation Engine Business
- Burlington, N.C.

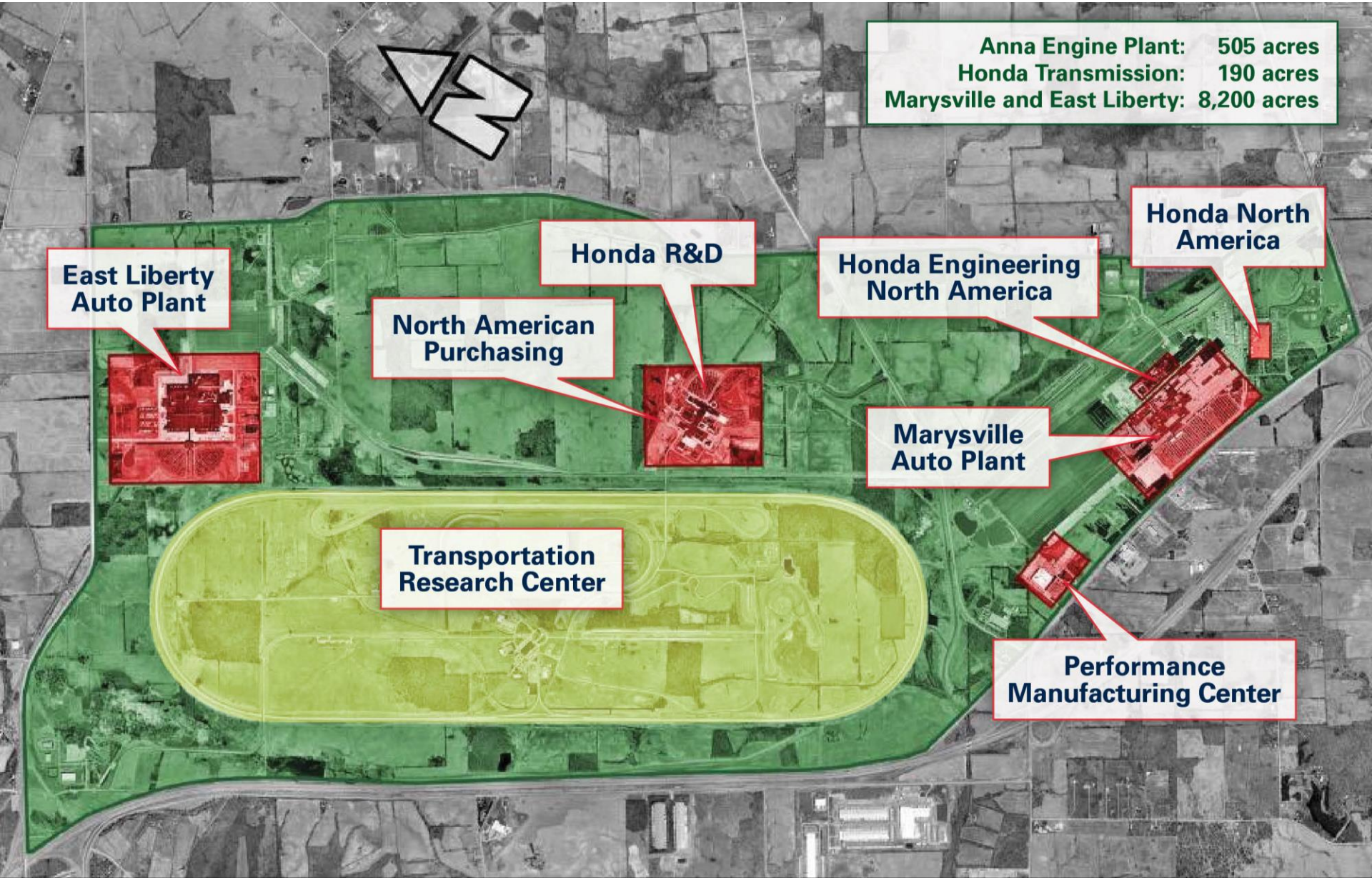
Honda Aircraft Company, LLC (2006)
- Development, Sales and Production of the HondaJet
- Greensboro, North Carolina

Honda Precision Parts of Georgia, LLC (2006)
- Automatic Transmissions
- Tallapoosa, Georgia

Honda Manufacturing of Indiana, LLC (2008)
- Automobile Production
- Greensburg, Indiana

Honda North America Services, LLC (2013)
- California, Ohio

Honda in Ohio



Central Ohio Location

Honda R&D Americas - Ohio Center

- HRA's Ohio R&D Center was established in 1985
- First vehicle was developed in 1990
- Employed 100 people in 1992, now employs over 1300
- HRA-O has developed over 20 different automotive vehicles

HRA-O facility now supports both Automotive and Power sports R&D

Honda R&D Americas Recent Developments


‘14 Honda Pioneer 700-4


‘14 Honda Odyssey


‘15 Acura MDX


‘15 Acura TLX


‘14 Honda HRR

Development focus is mostly on the North American customer

Data Management at Honda R&D

Objective : Establish a standards based data mgmt. system for Emissions testing

Previously …

- Folder Structure(Network Drives)
- Lotus Notes
- Database
- PC's
- Test Comps
- Ext. HDD
- ……

- File Format
- Search
- Auto-Report
- Data Retention

HRA-O Today

- Multi-Domain DM
- Coordination & Effort?

Aero
Safety
NVH
Emissions
Brakes

Waiting..

- ✓ Local & Global Hierarchy
- ✓ Std. File Format
- ✓ Search
- ✓ Auto-Report
- ✓ Data Retention
- ✓ …

Ideal

Achievement Method

Aero
Safety
Bushings
Emissions
Brakes

Specialized (Local) Data Management

SHARE GLOBAL DATA

Requirements Management

Global Component
(KPI's* & Reports)

Supplier
Factory
R&D JAPAN
R&D USA
- Management
- Designer

* Key Performance Indices (KPI)

Standard Data Acquisition
ECU
Dynamometer
VETS

IMPORTER

AVL
HORIBA
NATIONAL INSTRUMENTS

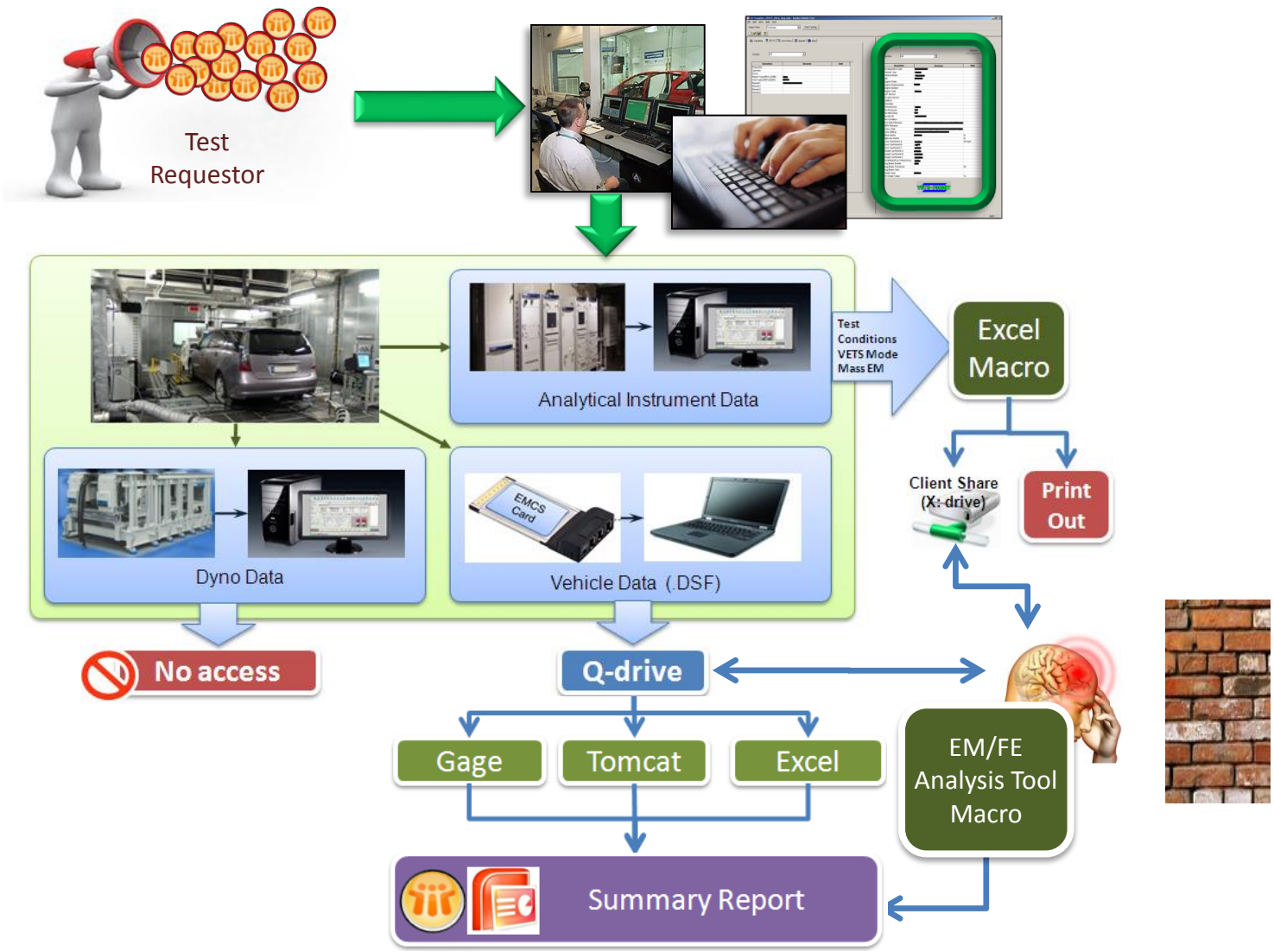
Simplified access to data for automated analysis and reporting to improve development efficiency

Focus for this activity

No.	Item	Requirement
1	Acquire data from multiple test sources	Acquire, Synchronize, and Analyze the data from multiple data sources and store it in a common file format and location
2	Standardize on ASAM Data format	Develop Application Data Model and import script to support Emission testing
3	Analysis & Report Generation of Emissions Tests	Develop a process to Analyze Data & Automatically Generate Emissions Test Reports
4	Define data sharing and connectivity scope at an enterprise level	Research for next phase

Emissions Lab Previously….

Emissions Testing Process…..Previously



Previous test data flow was very cumbersome and inefficient, Data integrity was lost and there was no standardization

Issues with non-standard systems

- **Test Data Quality**
  - Test condition information is often not available or incorrect
  - No consistent meta data in test runs

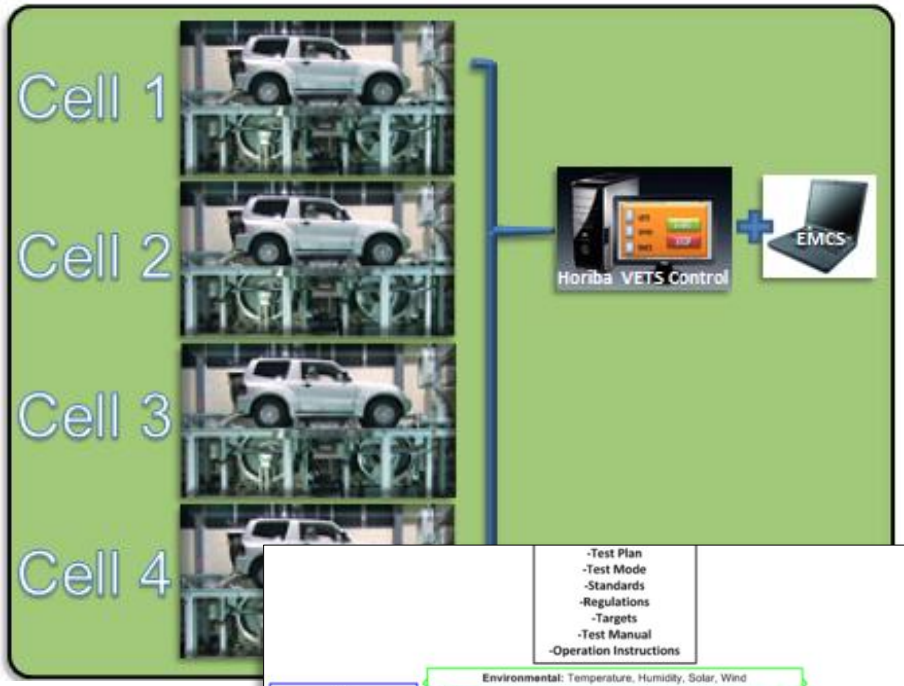
- **Access to test data**
  - Limited access to VETS, Dynamometer & CRSD data
  - No sync between the ECU, Emissions and Dynamometer data
  - Test data is stored in multiple locations depending on PIC preference
  - Difficult to find & filter specific tests

- **Analysis Methods and Tools**
  - Multiple Analysis tools to Analyze data
  - Multiple data sources and formats – difficult to process data consistently
  - Current analysis process is manual and time consuming
  - Manual report generation - Inconsistency

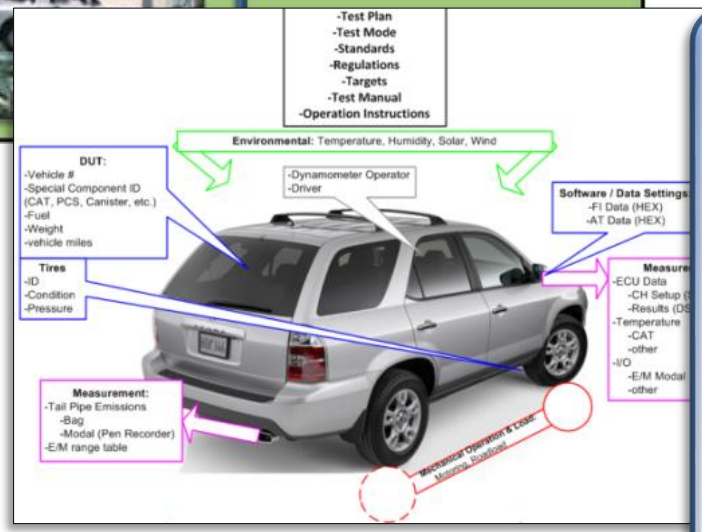
Lack of Standards and Consistency is slowing us down during testing

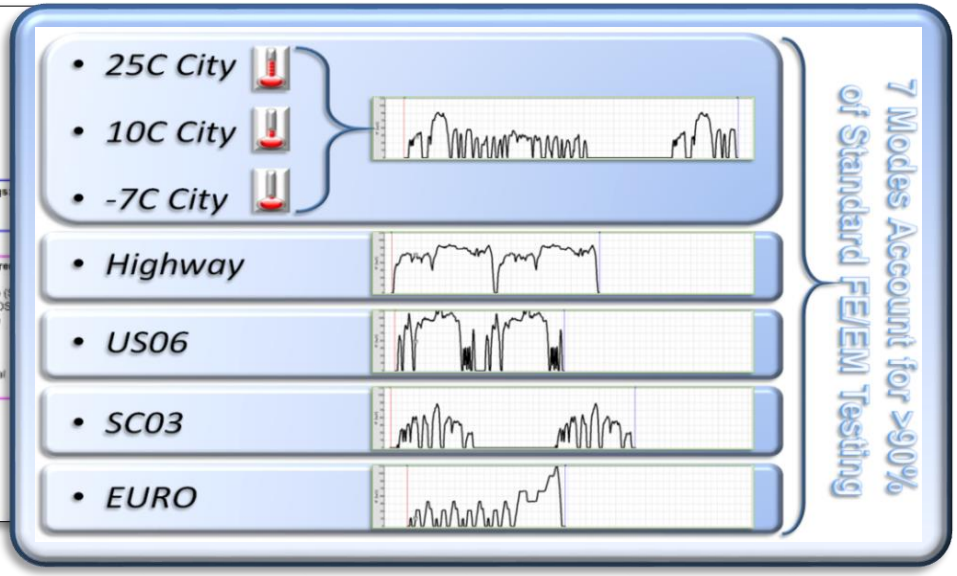
Project Scope….

Scope, Target Test Modes & Application Strategy



- **Emissions cells share very similar data sets which leads well to database standardization**
- **ASAM architecture will allow for future expansion to Emissions Transient Dyno (ETD)**





All Standard EM data will be acquired, synchronized and stored in an ASAM ODS database for post processing and reporting

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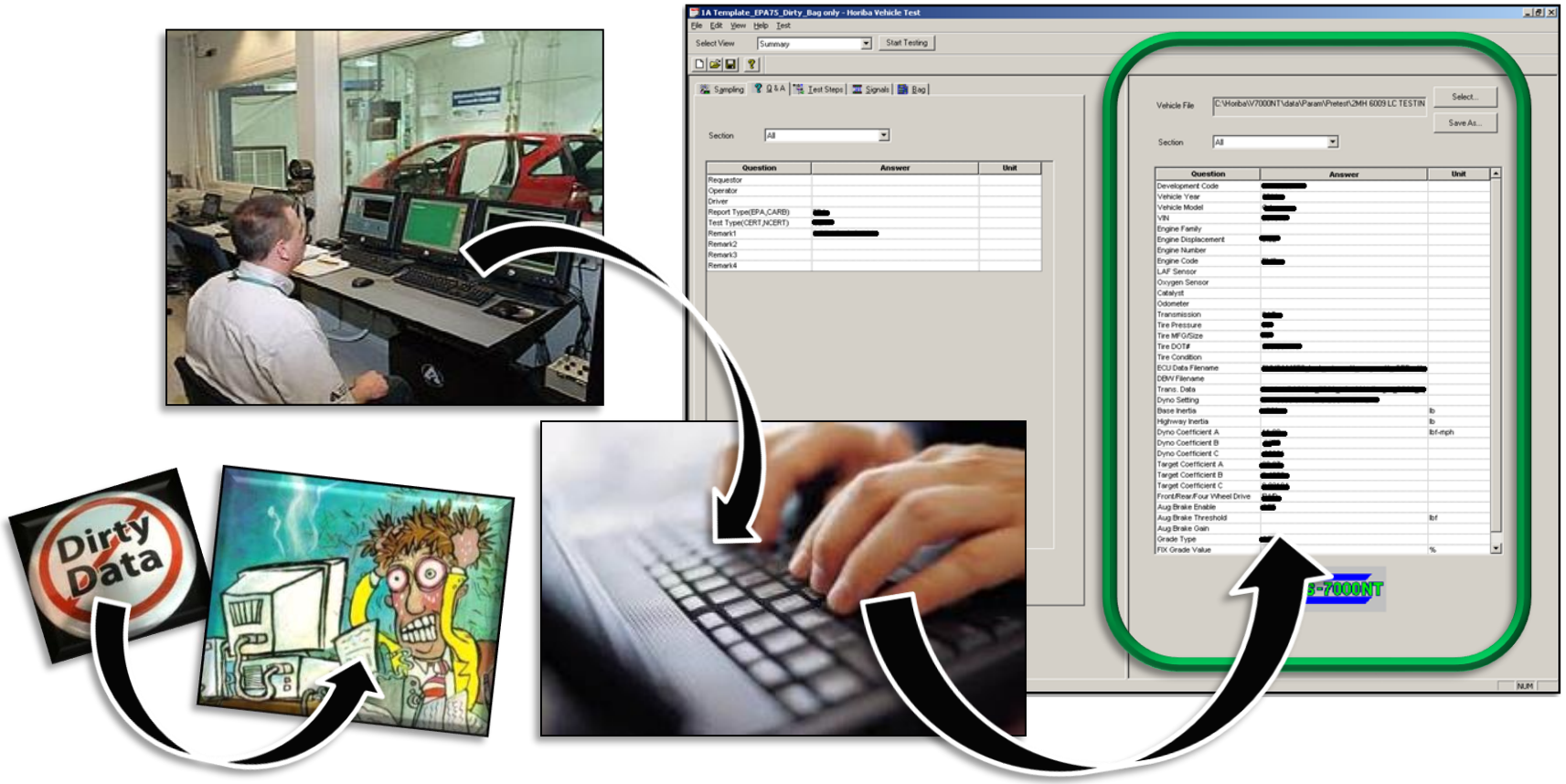
Test Request Procedure

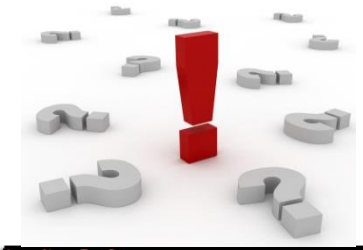
- Previously procedure for test setup is as follows:



- Manual entry by operators
- No access to network files (Hex, R/L, etc)
- Time consuming & Tedious
- This causes delays, errors, and is often ignored

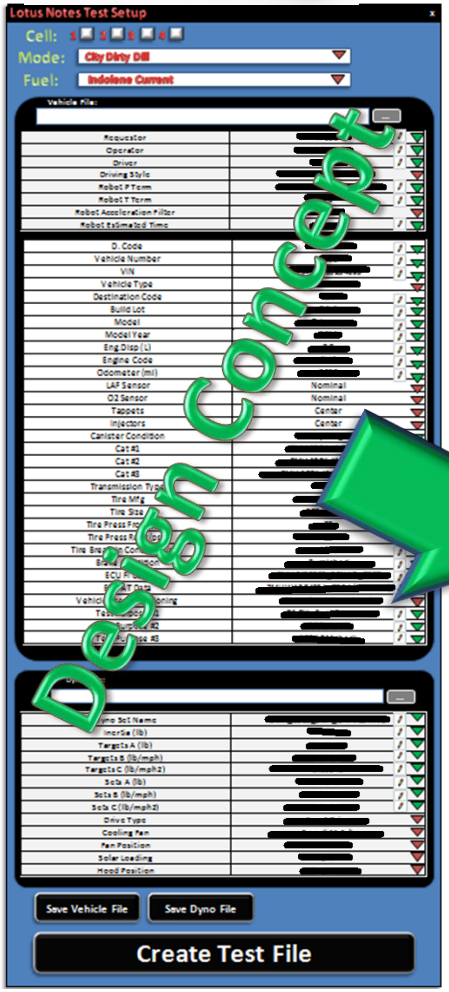
Due to the inconvenience, often the test setup information is not updated or is incorrect

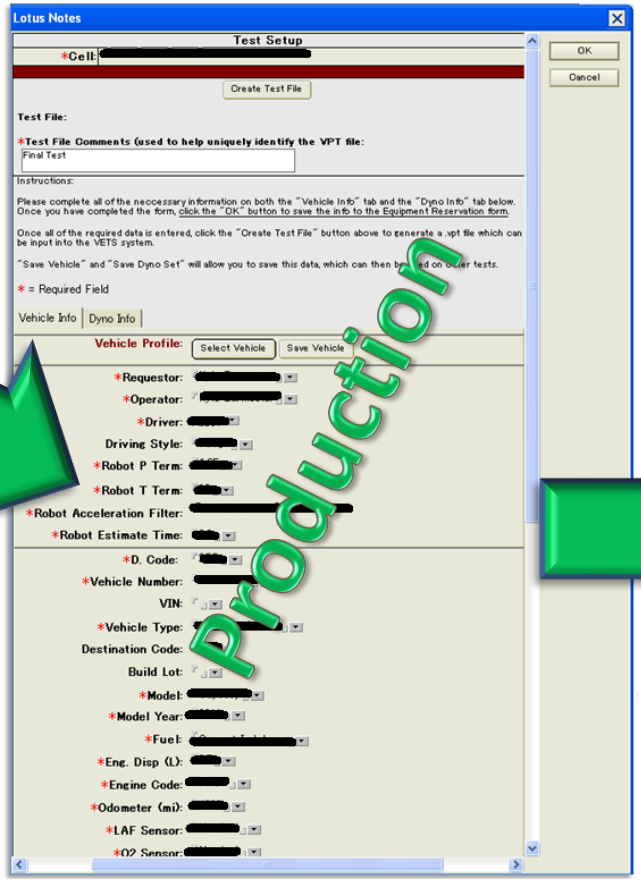
Test Information Quality

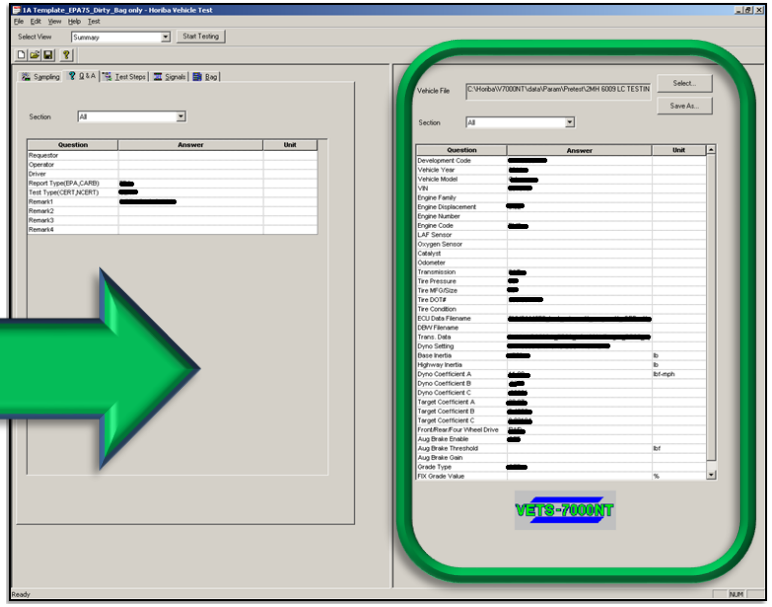


Solution:

- **Lotus Notes Scheduling DB:**
  - ✓ Mandatory Test Condition Information
  - ✓ Consistent meta data capture for all tests
  - ✓ Generated test setup file -> VETS Input







Standardized meta-data capture and scheduling system put in to production

Issues with non-standard systems

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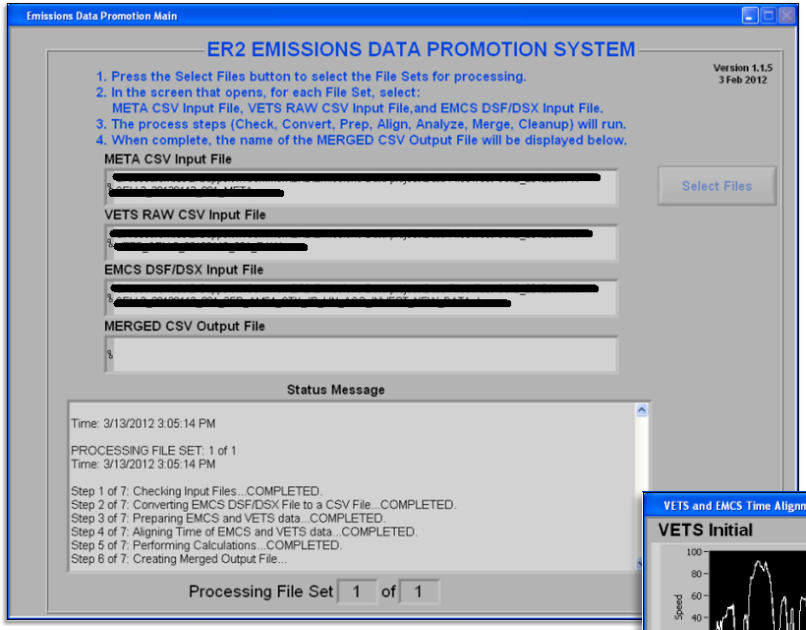
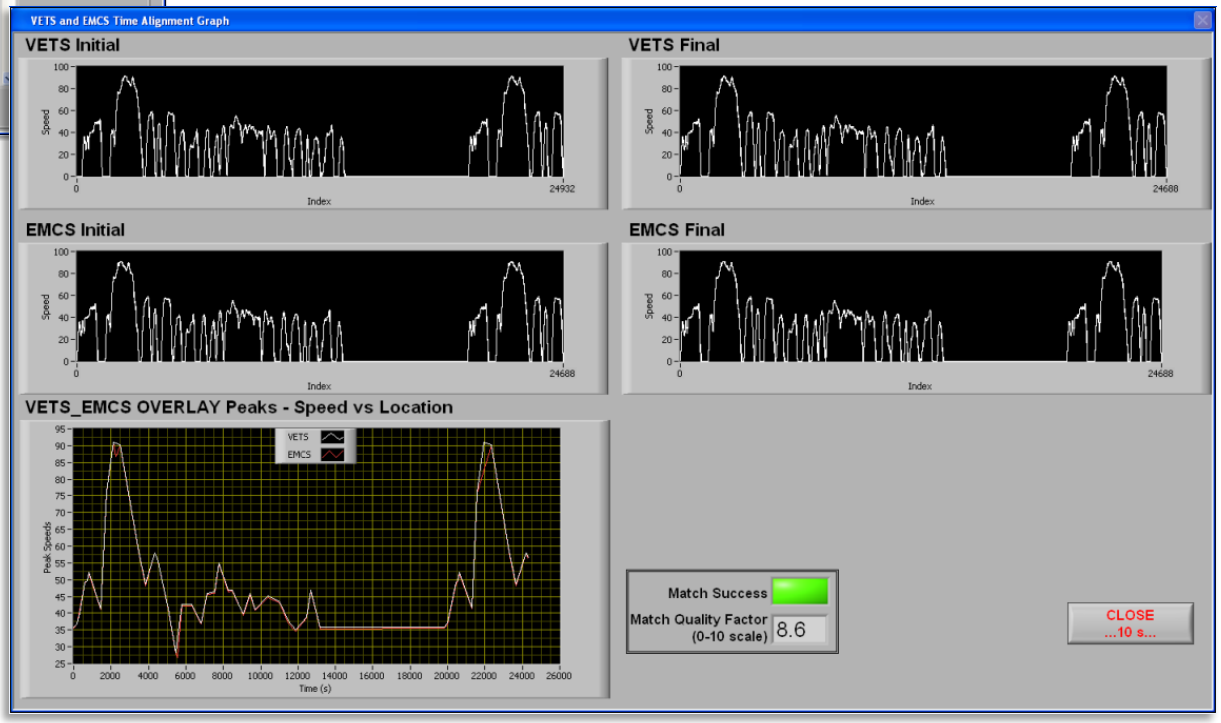
Combining & Synchronizing File Formats



LabVIEW tool for combining multiple files:

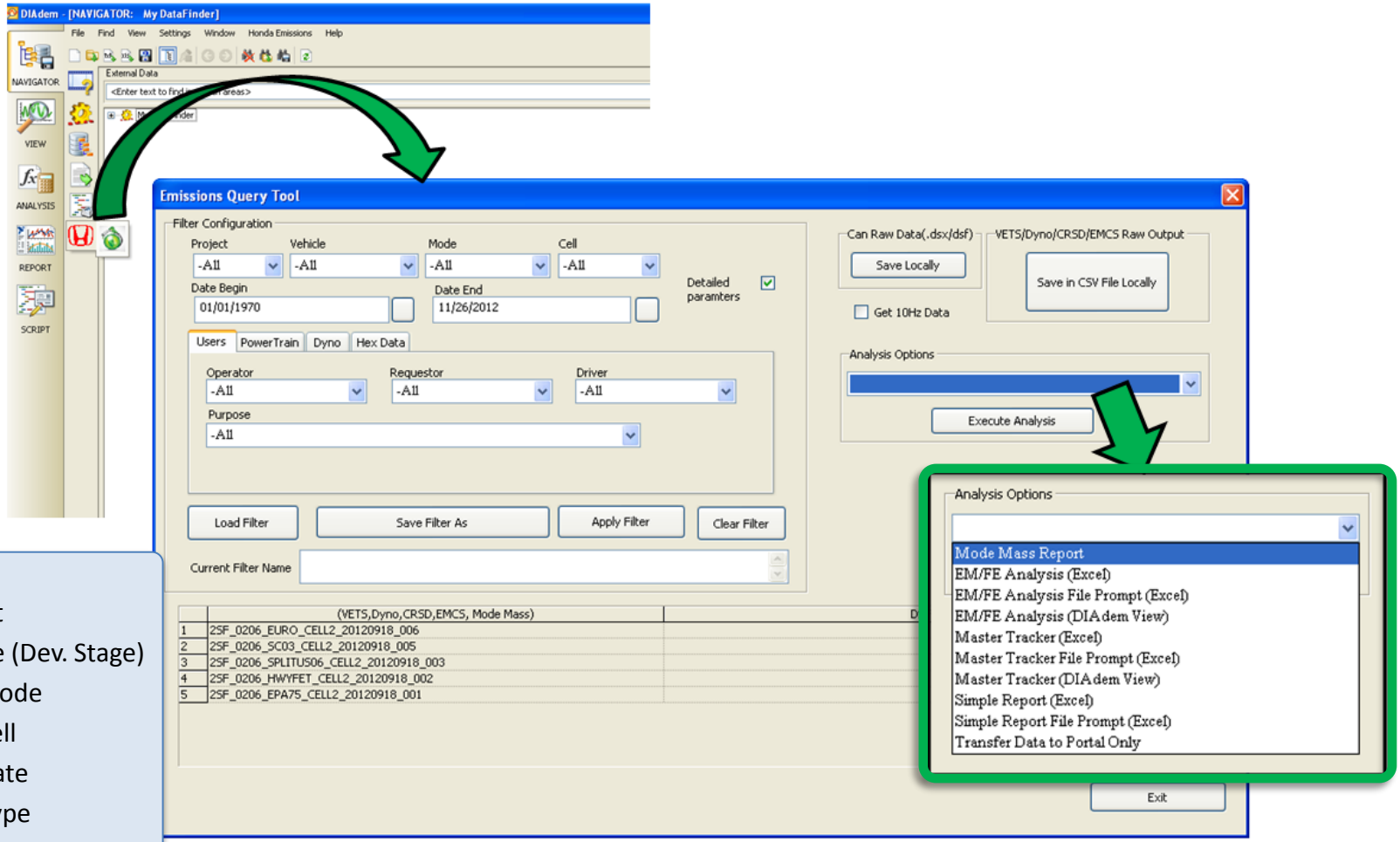
- Takes Dyno 10hz, VETS 10hz, CRSD 10hz, EMCS 10hz, & VETS META data and creates ONE .csv file.
- Performs time alignment with a quality factor
- Performs specified EM/FE calculations (NE, PBA, VP, CSTP, NGR, DE, etc.)
- Built in error trapping to prevent bad data from being put into the DB



LabVIEW tool to synchronize datasets and perform calculations

Test Data Access

- ✓ Common location for storing all data (ASAM ODS based DB)
- ✓ Data is time synchronized
- ✓ Query tool will search and filter data



- Search by:
  - ❑ Project
  - ❑ Vehicle (Dev. Stage)
  - ❑ Test Mode
  - ❑ Test Cell
  - ❑ Test Date
  - ❑ Fuel Type
  - ❑ .....

Providing simplified access to the database is the key to success for any TDM project

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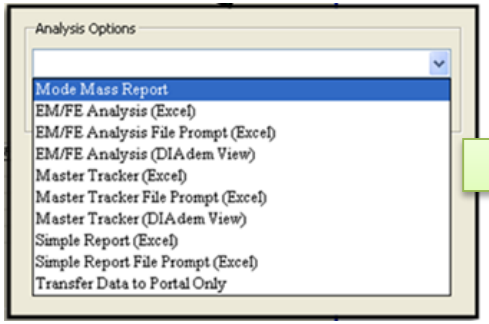
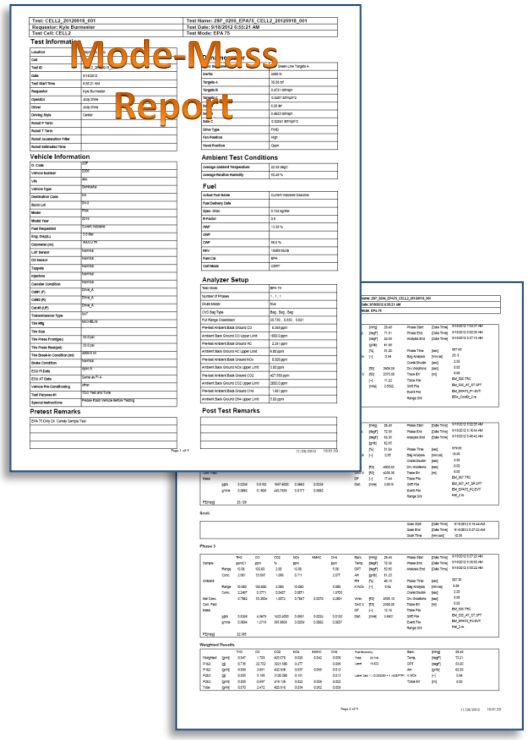
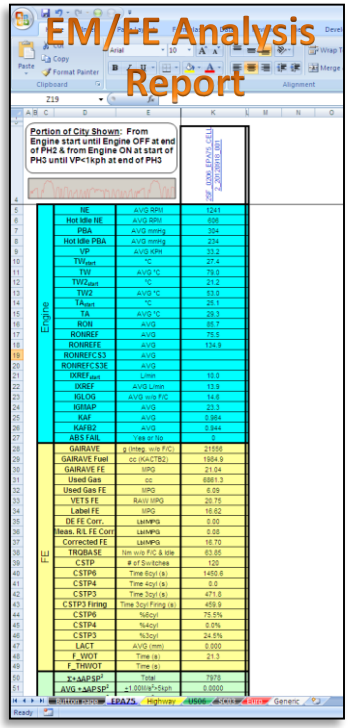
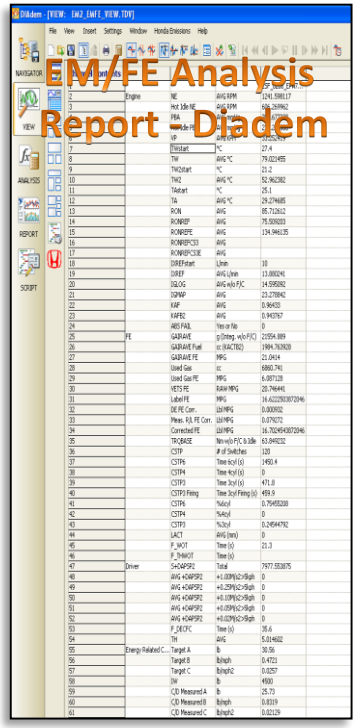
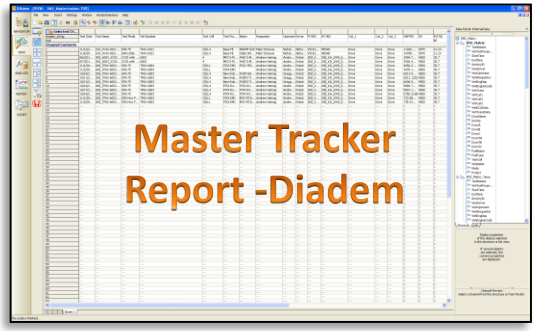
Report Templates

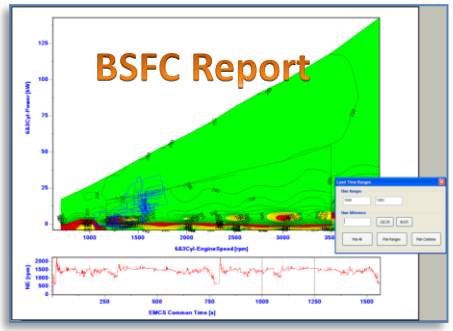








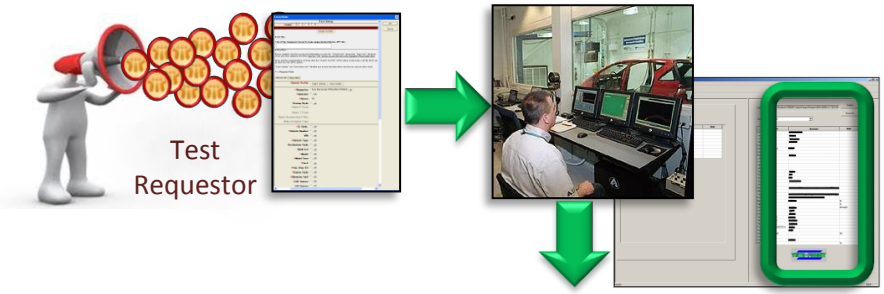


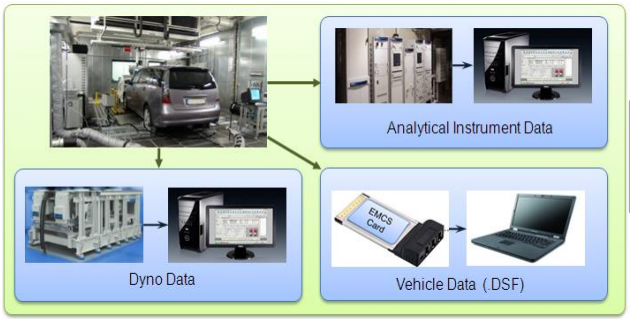


8 Different Report Templates to Choose From

Emissions Lab Today…

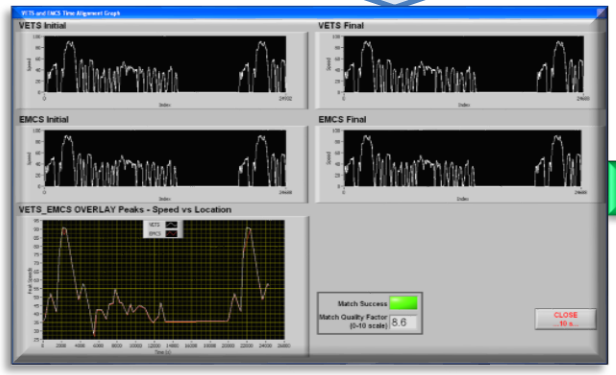
Overall Status of Test Data Management





Acquire all data for each test

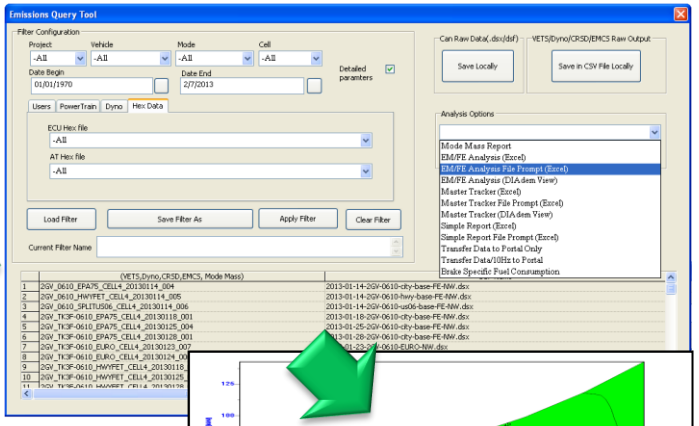
Streamlined Process for Test Set-up and Data Management

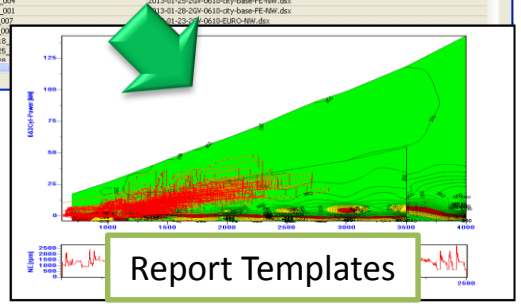


IMPORTER

ASAM ODS DB

Search & Analyze Tool





Report Templates

Data Mgmt. benefits to emissions group

Capability

- ***Access to test data***
  - Now have **access to ALL measurement data** (VETS, Dyno, & CRSD data)
  - All test data is time **synchronized**
  - Data is stored in **ONE central location**
  - Easy to **find & filter** specific tests
- ***Test Data Quality***
  - Test condition and vehicle information is now **standardized**
  - **More test & setup information** is now available to users
- ***Analysis Methods and Tools***
  - **Improved Analysis tools** to Analyze data
  - **Consistent data** and formats – easy to process data
  - **Automated analysis** process for many items

Efficiency

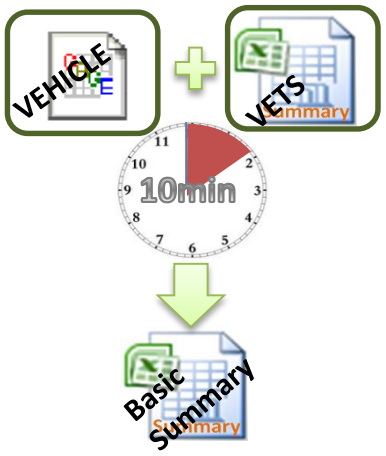
- ***Efficiency Improvement***
  - **Minimize test "RE-DOs"** due to poor file storage and tracking
  - **Maximize data sharing** between PIC's
  - **Significant Time savings**

Overall benefit of data management system

Capability & Efficiency - Example

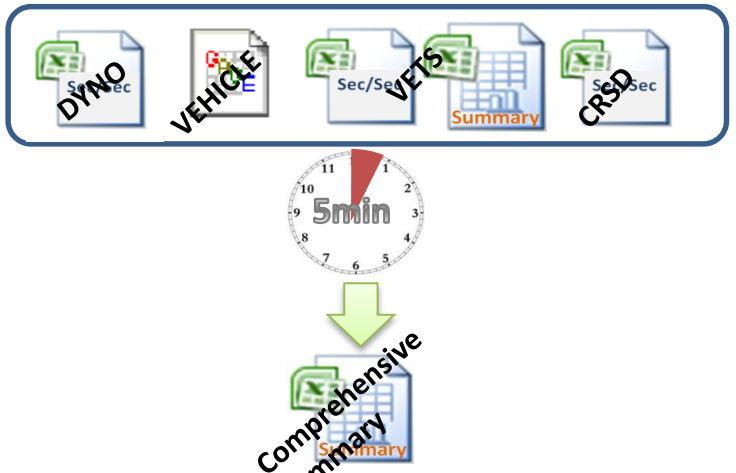
Test Analysis (0→1 weeks Post Test)

Before DB



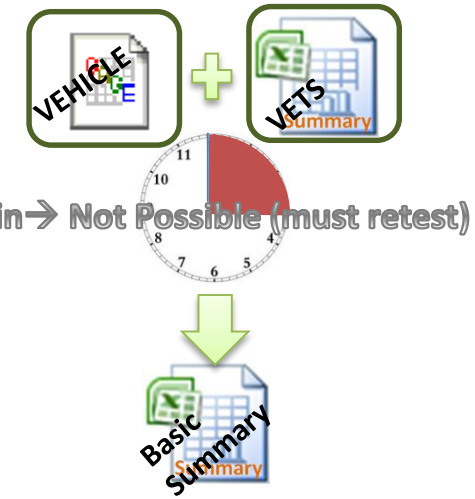
80% Confidence

After DB

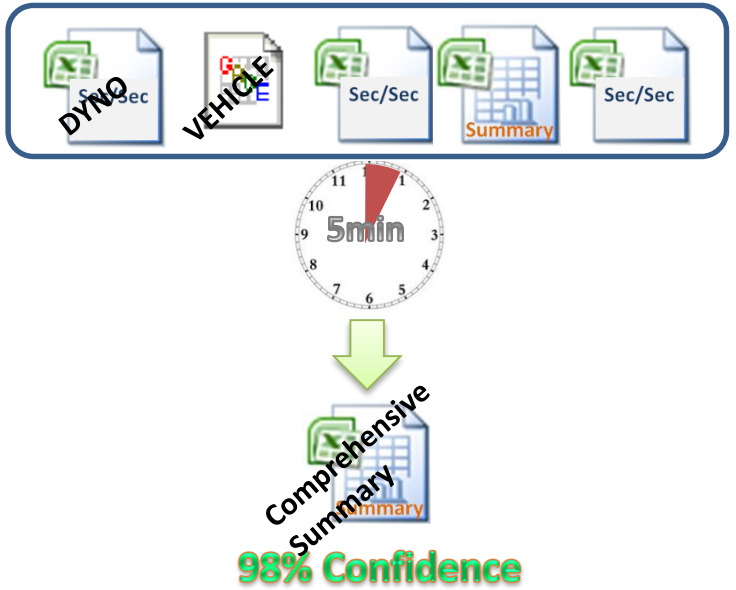


98% Confidence

Test Analysis (2→50+ weeks Post Test)



< 20% Confidence



98% Confidence

Significant savings in efficiency due to high confidence in available data

Future Data Management Activities

- Honda R&D Japan and Honda R&D Ohio are working closely to establish a data management framework for future data management projects based on ASAM ODS standard

- The goal for this activity would include the expansion of test data management and exchange of test data seamlessly between the two organizations

Several global initiatives to standardize on ASAM standards in Honda

Q & A

HONDA
The Power of Dreams