



*UNITED STATES*  
**DEPARTMENT OF TRANSPORTATION**

# **Overview of the Dynamic Mobility Applications (DMA) Program Webinar**

DCM/DMA Summer Webinar Series

Kate Hartman

July 20, 2011

# Overview of Webinar

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- **Purpose**

- Provide an update on DMA program status, key program priorities, and next steps

- **Agenda**

- Introduction to the DMA Program  
*Kate Hartman*
- High Priority Application Bundle Presentations  
*USDOT DMA Bundle Leads*
- DMA Program Next Steps  
*Kate Hartman*
- Discussion



# ITS Strategic Research Plan 2010-2014

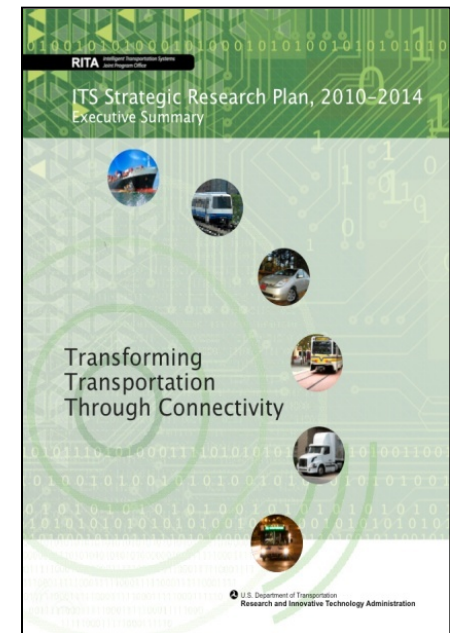
## A Truly Multimodal and Connected Effort

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### Vision

To research and facilitate a national, **multimodal surface transportation system** that features a connected transportation environment around **vehicles of all types**, the infrastructure, and portable devices to serve the public good by leveraging technology to maximize safety, mobility, and environmental performance.

Plan developed with full participation by all surface transportation modal administrations as well as with significant interaction with multi-modal stakeholders.



# ITS Research = Multimodal and Connected

To Improve Safety, Mobility and Environment

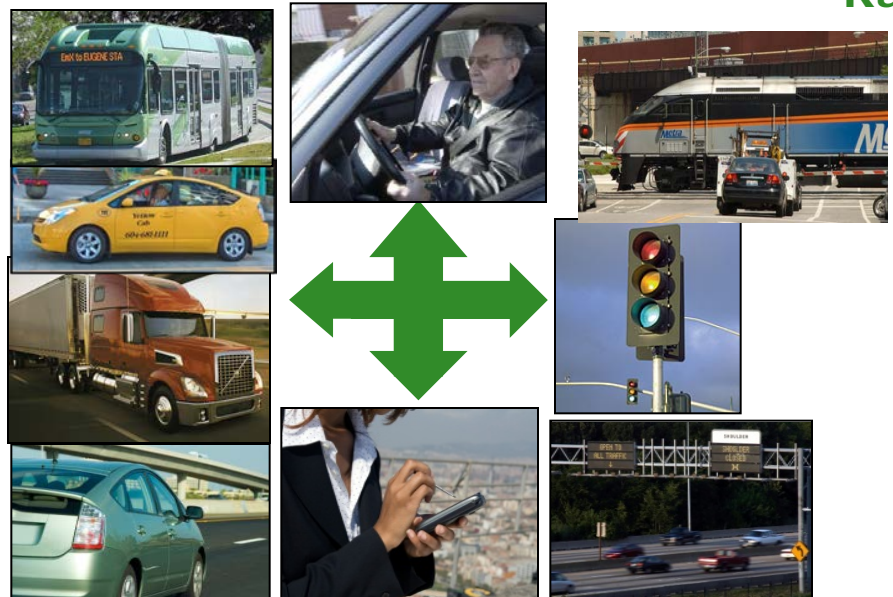
Research of technologies and applications that use wireless communications to provide connectivity:

- Among vehicles of all types
- Between vehicles and roadway infrastructure
- Among vehicles, infrastructure and wireless consumer devices

Vehicles and Fleets

Drivers/Operator

Rail



Wireless Devices

Infrastructure

FCC Allocated Spectrum at 5.9 GHz for Transportation Safety (known as DSRC)



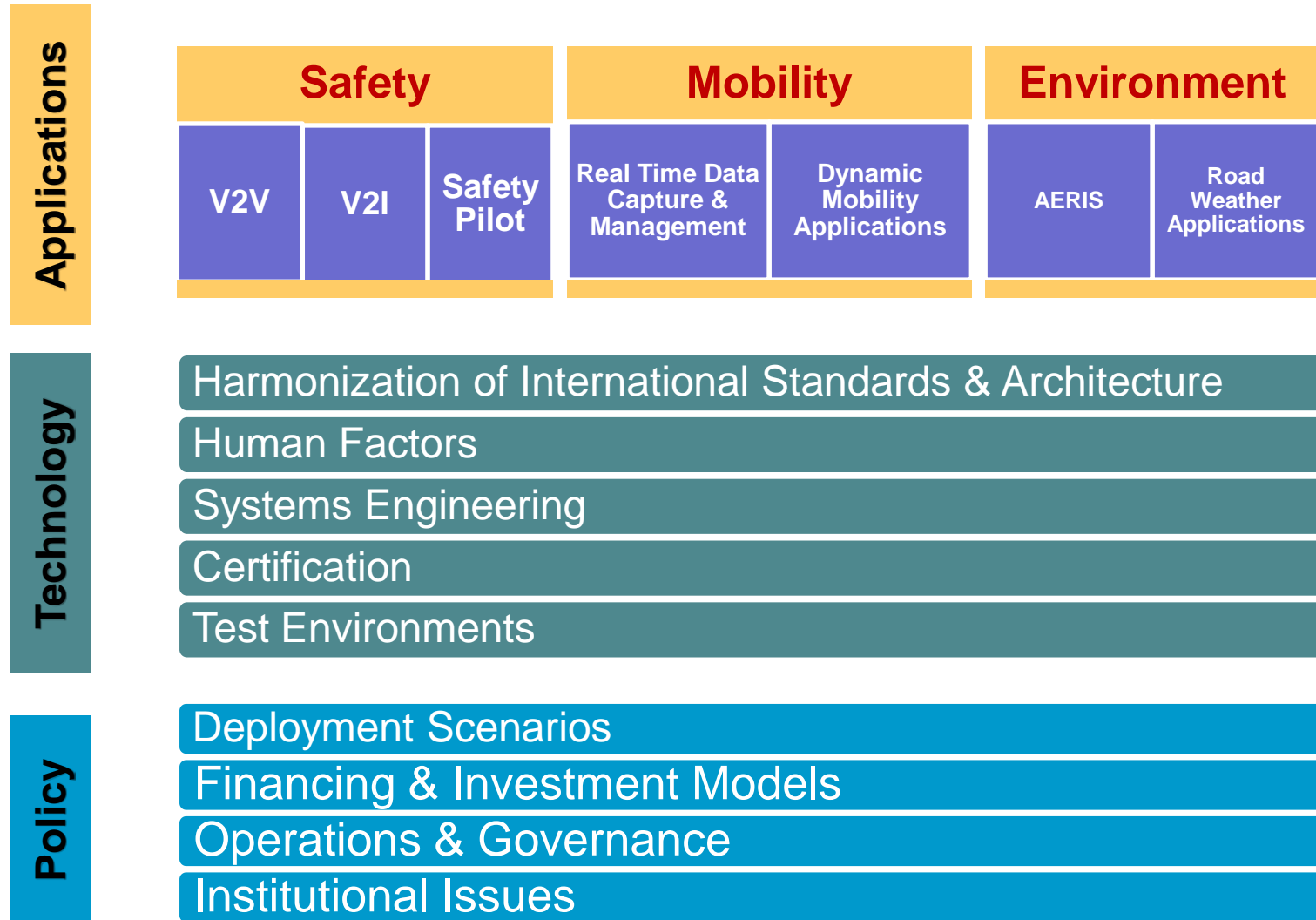
# Major Objectives

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- Move aggressively on vehicle to vehicle communications
  - Regulatory Decision on In-Vehicle Equipment by 2013
- Accelerate in-vehicle technology
  - “Here I Am” messages
  - Aftermarket Safety Systems
  - Enables safety and active traffic management
- Accelerate infrastructure communications capability
  - Signal Phase and Timing (SPaT) as initial focus
  - Enables safety, mobility, and environmental applications
- On road multi-modal pilot deployments for high-value applications
- Monitor and evaluation of driver distraction issues
- Understand data and communications needs (DSRC/other) of transformative mobility applications – and the potential benefits of these applications



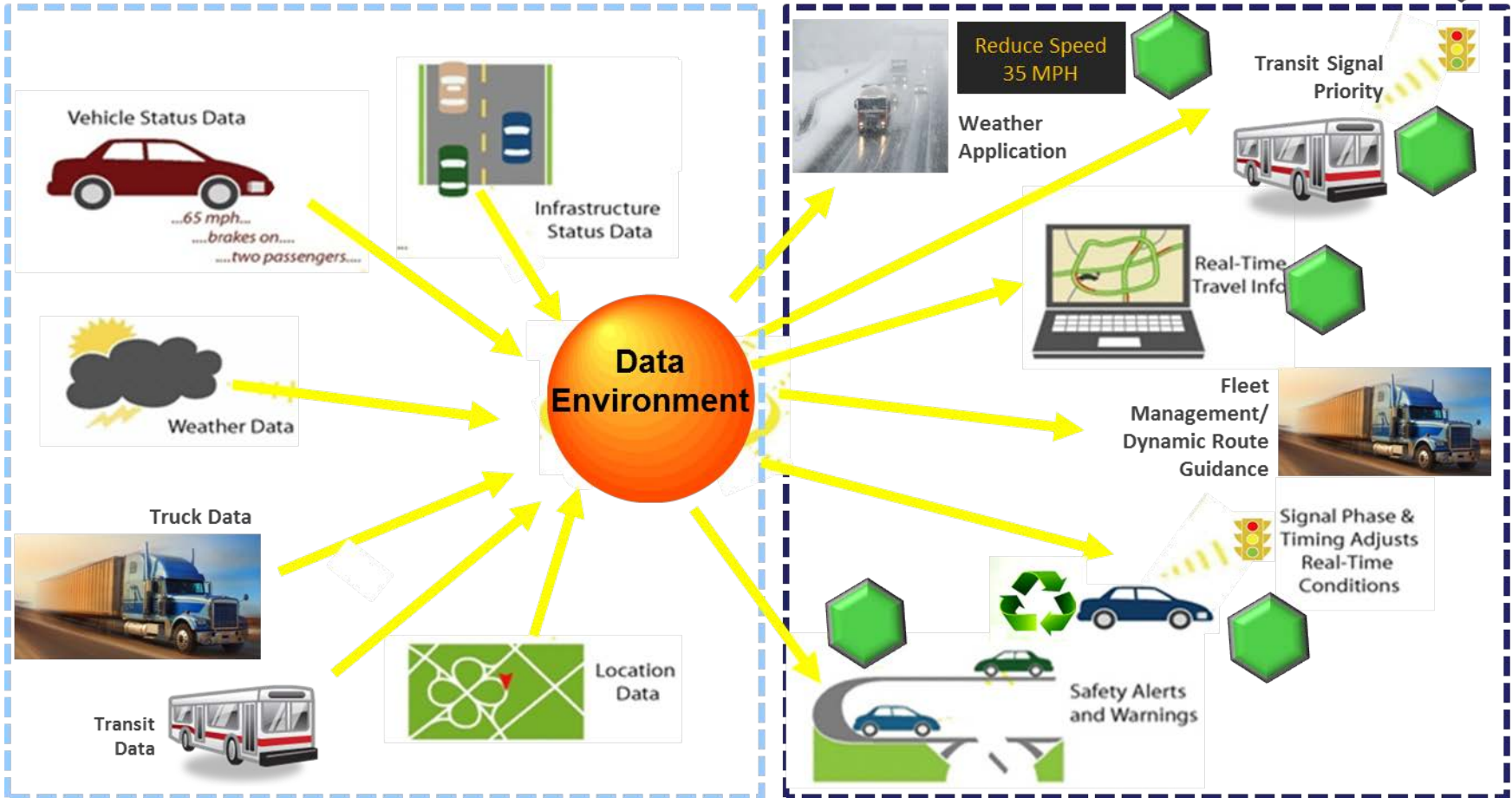
# ITS Research Program Components



# Mobility Program

## Real-time Data Capture and Management

## Dynamic Mobility Applications



# Dynamic Mobility Applications Program

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## Vision

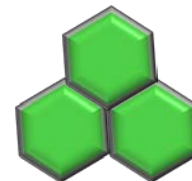
- Expedite development, testing, commercialization, and deployment of innovative mobility application
  - maximize system productivity
  - enhance mobility of individuals within the system

## Objectives

- Create applications using frequently collected and rapidly disseminated multi-source data from connected travelers, vehicles (automobiles, transit, freight) and infrastructure
- Develop and assess applications showing potential to improve nature, accuracy, precision and/or speed of dynamic decision
- Demonstrate promising applications predicted to significantly improve capability of transportation system
- Determine required infrastructure for transformative applications implementation, along with associated costs and benefits

## Project Partners

- Strong internal and external participation
  - ITS JPO, FTA, FHWA R&D, FHWA Office of Operations, FMCSA, NHTSA, FHWA Office of Safety



## Transformative Mobility Applications

*(May have more impact when BUNDLED together)*





# Dynamic Mobility Applications Program: Current Progress Against Objectives

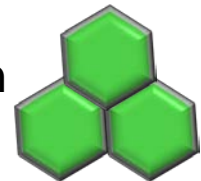
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- **Current Focus:**

- Create, develop, and demonstrate applications using multi-source data

- **Transformative Application Bundles**

- 9-month process to engage stakeholders and make a decision
- We collected innovative, transformative ideas
- We prioritized stakeholder and federal interest
- Identified the most promising applications to pursue in Phase 2  
(Announced at TRB 2011)



- **Open Source Portal**

- Foundational capability to share and coordinate application development
- Currently developing detailed concept of operations

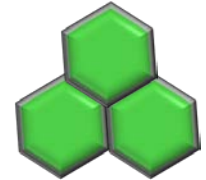


# Transformative Application Bundles: Identification of Prioritization Approach

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## Goal

- Identify, with help of stakeholders, collection of applications for development and testing in Phase 2 of Program



## Approach

- Solicit ideas for transformative applications
  - Initial request closed on 31 July; second call closed 15 October
  - More than 90 submittals, quantity and quality exceeded expectations
- Share concepts with our stakeholders throughout the process
- Refine concepts to a manageable set of consolidated concepts (33)
  - Consolidated concepts used in variety of exercises at Mobility Workshop, 11/30-12/1/10 and with other stakeholder groups
  - ITE Task Force, Transit stakeholders, Freight stakeholders
- Combine stakeholder and federal input to support program prioritization

## Transformative Mobility Applications

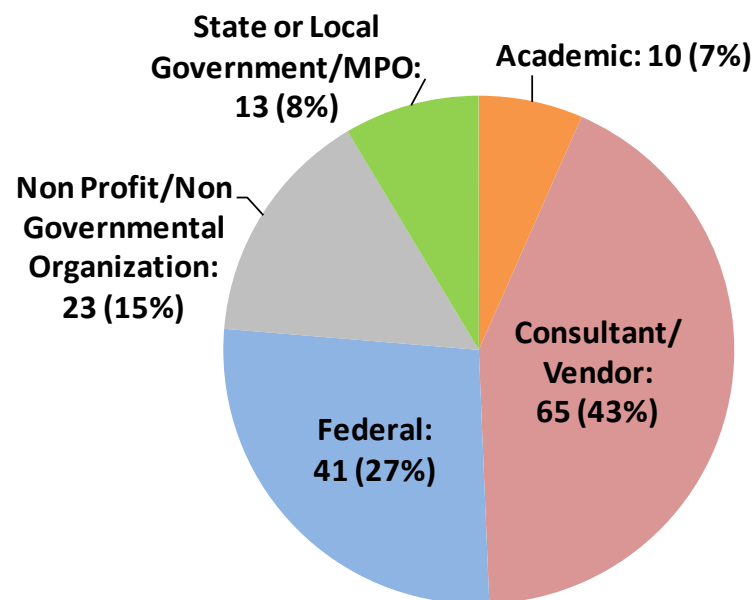
## Candidate Applications Prioritization Criteria

- Potential for transformative impact
- Makes use of connected vehicle data
- Significant stakeholder interest



# Mobility and Environment Workshop

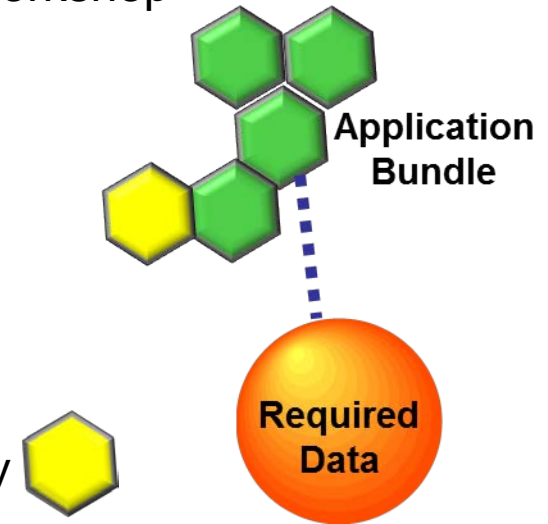
- GMU-Arlington, 11/30-12/1/2010
- 152 registered attendees
- Goals
  - Inform stakeholders
  - Motivate stakeholder participation
  - Capture feedback on applications
- **Each participant rated each application on three criteria (High, Medium, Low)**
  - **Potential Impact:** will this application have transformative impact?
  - **Deployment Readiness:** if we assume data is available, can this application be developed, tested and widely deployed by 2025?
  - **Program Alignment:** does the application align with program objectives and is there a clear federal role in its development and deployment?
  - Each participant scored and commented on each concept on a scorecard



# Transformative Application Bundles: Bundling Rationale and Prioritization Process

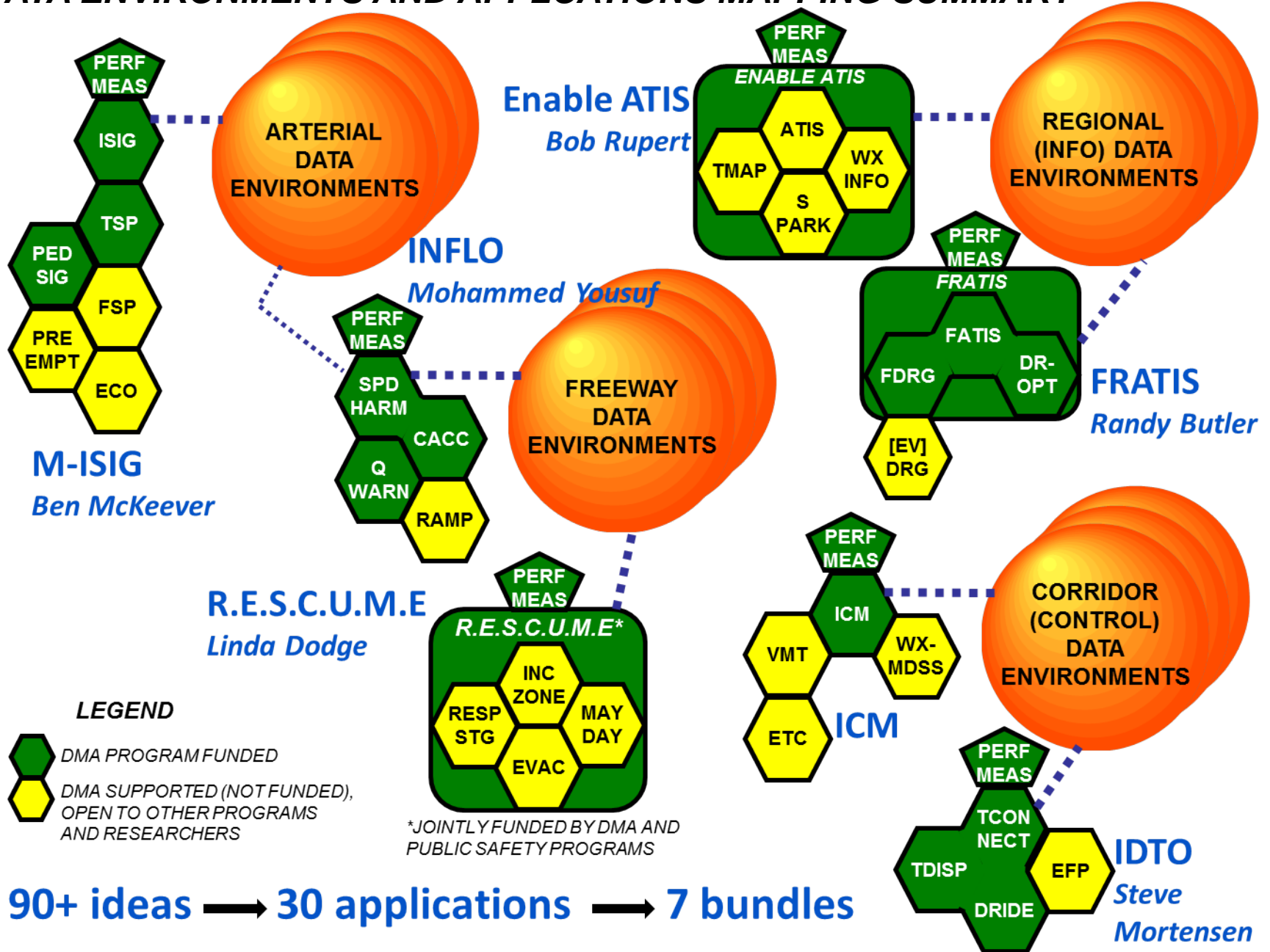
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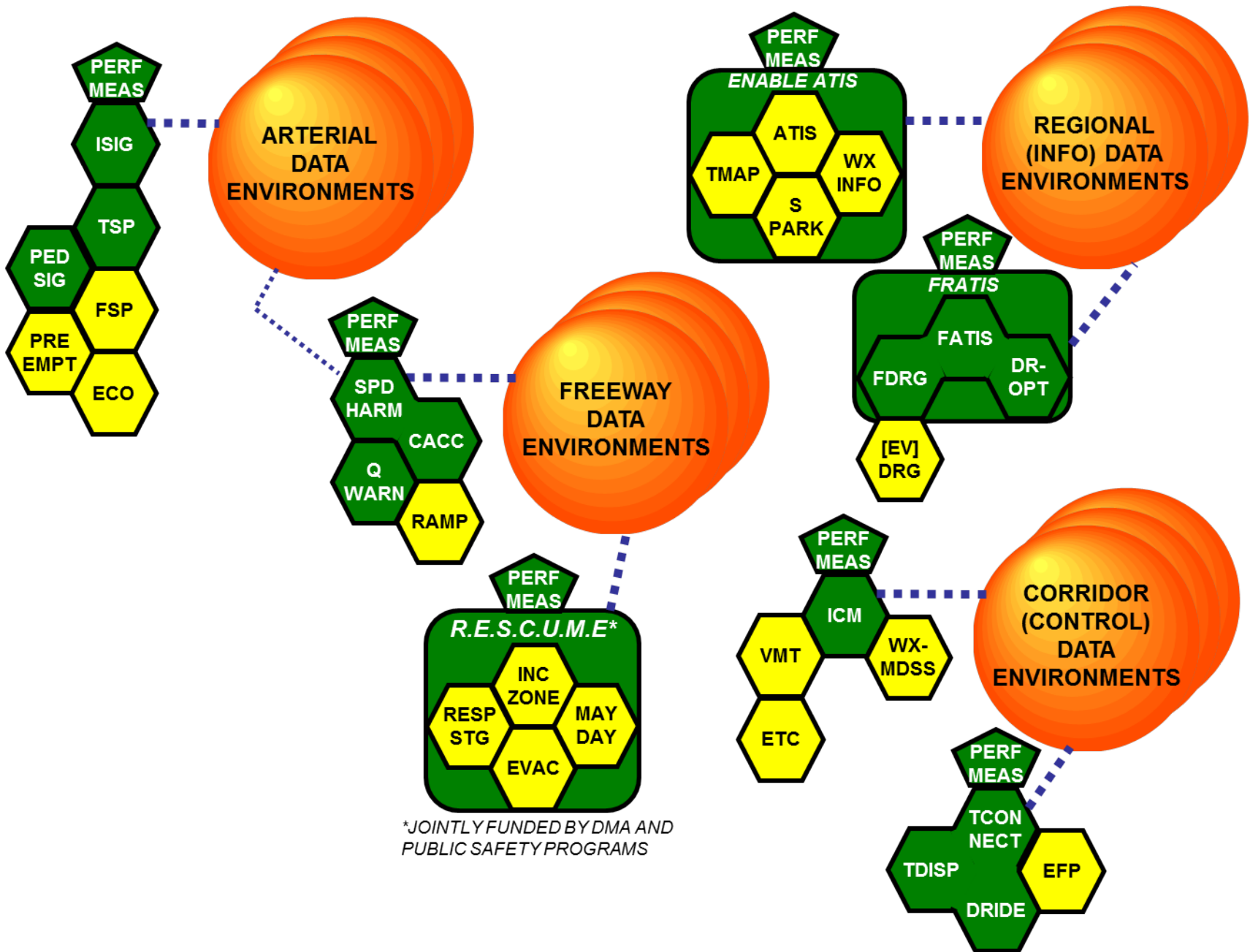
- Consolidate input from external stakeholder groups, workshop
- Consider internal stakeholder priorities
  - Leveraging on-going or other planned research
- **Group Applications into Bundles**
  - Similar high-level data needs
  - Interaction among applications predicted
  - Evident value in concurrent development
  - Encourage coordinated non-federal research activity
- **Bundling increases transformational impacts and reduces costs of research and development**
- Resource-constrained prioritization process based on expected value of developing application bundles, as well as individual applications
  - Applications the program cannot fund at this time are still candidates for collaborative development with other programs or stakeholders
- **High-Priority Application Bundles announced at TRB 2011**

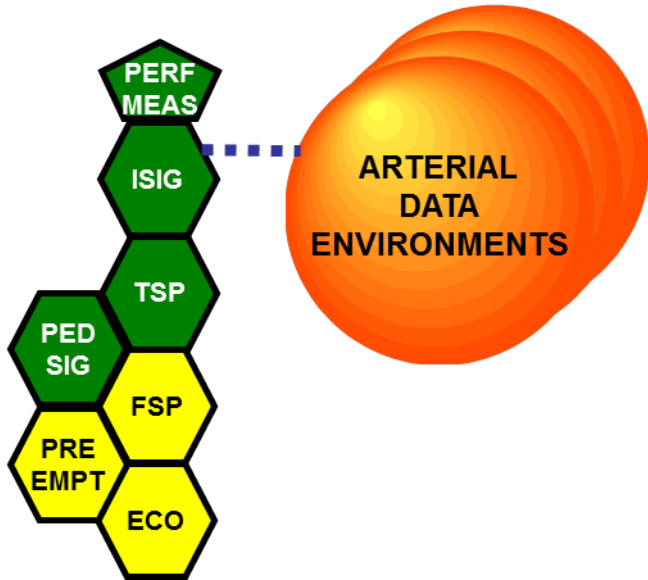


# DYNAMIC MOBILITY APPLICATIONS PROGRAM

## DATA ENVIRONMENTS AND APPLICATIONS MAPPING SUMMARY





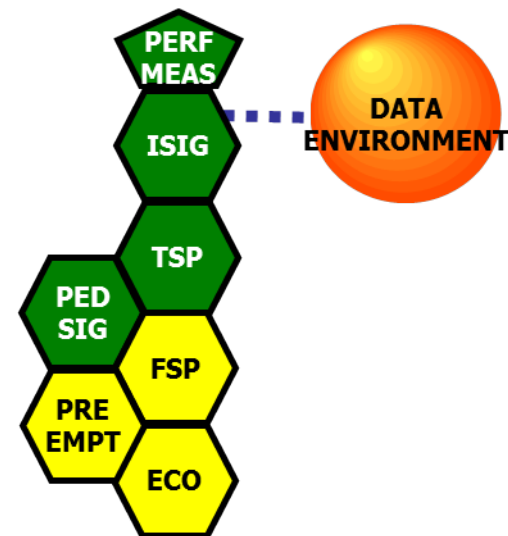


**M-ISIG**

**Ben McKeever**  
FHWA Office of Operations R&D

# Multi-Modal Intelligent Traffic Signal System (M-ISIG Bundle)

- Comprehensive traffic signal system for complex arterial networks (passenger vehicles, transit, pedestrians, freight, and emergency vehicles):
  - Intelligent Traffic Signal System (I-SIG)
  - Transit Signal Priority (TSP)
  - Mobile Accessible Pedestrian Signal System (PED-SIG)
  - Freight Signal Priority (FSP)
  - Emergency Vehicle Preemption (PREEMPT)
  - Connected Eco Driving (ECO)



- Jointly funded by Cooperative Transportation System Pooled Fund Study (CTS PFS) and the DMA Program
  - CTS PFS is led by VDOT and members include FHWA and over 10 state and local agencies
  - Focuses on prototyping and testing practical infrastructure oriented applications that lead deployment



# Intelligent Traffic Signal System (I-SIG)

- Integrates data collected through wireless communications and other sources to improve traffic signal operations
- Overarching system optimization application accommodating transit and freight signal priority, preemption and pedestrian movements maximize overall arterial network performance



# Transit Signal Priority (TSP)

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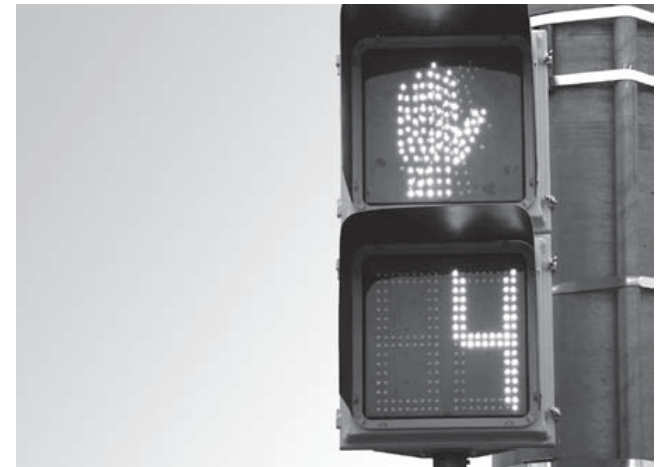
- Enables earlier, more accurate and continuous monitoring of transit vehicles as they approach and progress through the intersection, and potentially down an entire corridor
- Selects the most appropriate priority strategy based on knowledge of up-to-the second location and multiple conditionality criteria, such as:
  - Schedule/headway adherence
  - Passenger loads
  - Service type
  - Time of day
  - Peak direction
- Enables TSP on a network of arterials



# Mobile Accessible Pedestrian Signal System (PED-SIG)

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- Allows an “automated pedestrian call” to be sent to the traffic controller from the smart phone of registered blind users after confirming the direction and orientation of the roadway that the pedestrian is intending to cross.
- Integrates information from:
  - roadside or intersection sensors
  - new forms of data from wirelessly connected pedestrian-carried mobile devices
- Communicates wirelessly with the traffic signal controller to obtain real-time SPAT information
- Informs the visually impaired pedestrian as to when to cross and how to remain aligned with the crosswalk.



# Leverage Non-Federal Research Activity

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## **Freight Signal Priority (FSP)** *(PFS funded)*

- Provides signal priority along an arterial corridor near a freight facility based upon current and projected freight movements into and out of the freight facility.
- Reduces delays, increases travel time reliability for freight traffic.
- Enhances safety at intersections around the freight facility.

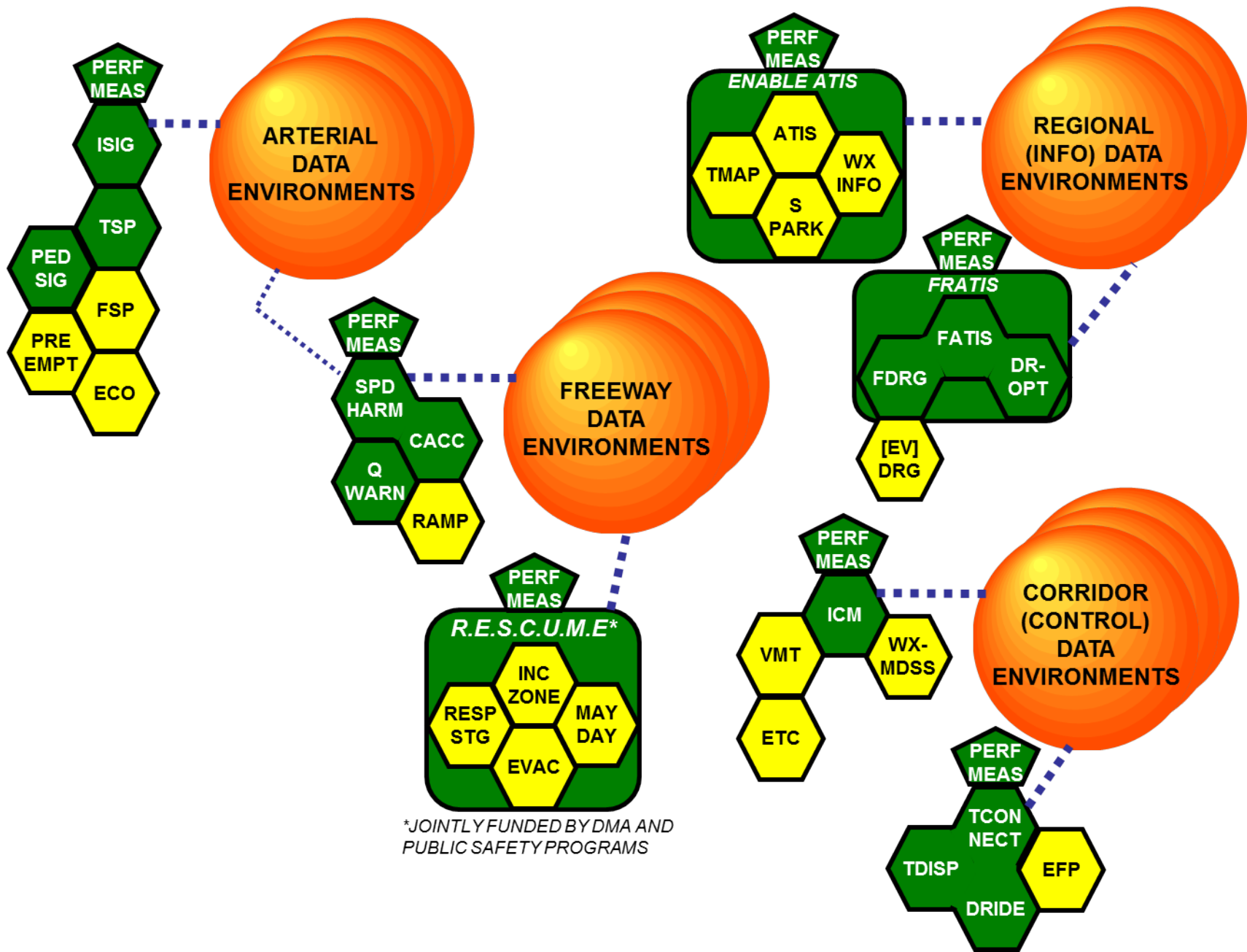
## **Emergency Vehicle Preemption (PREEMPT)** *(PFS funded)*

- Adjusts preemption and signal recovery cycles to account for non-linear effects of multiple emergency responses through the same traffic network.
- Replacement of optical, 900 MHz, and other technologies used for signal preemption with integrated V2V and V2I communication systems.

## **Connected Eco Driving (ECO)**

- Monitors current vehicle operation versus ideal operation for road-grade, predicted speed changes or braking, and real-time traffic changes.
- Provides feedback to the driver to keep the vehicle driving in an optimal manner (route, speed, upcoming situations to respond to, etc.).



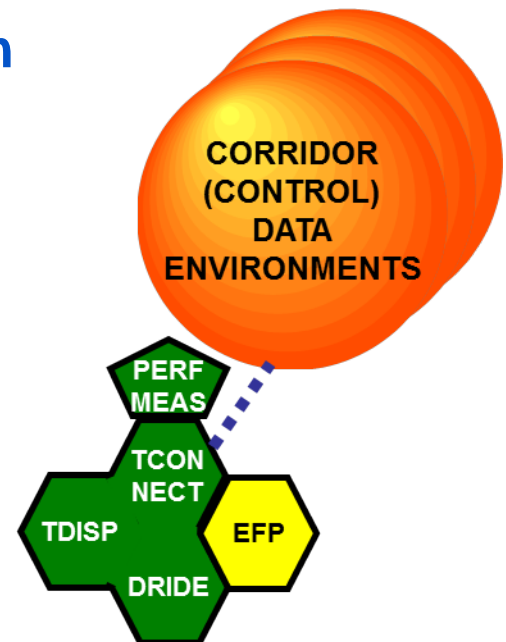


\*JOINTLY FUNDED BY DMA AND PUBLIC SAFETY PROGRAMS

# IDTO

## Steve Mortensen

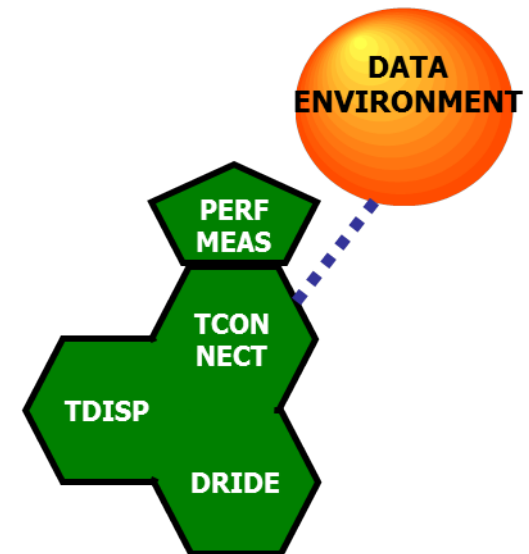
FTA Office of Mobility and Innovation



# Intelligent Dynamic Transit Operations (IDTO)

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- Integrated transit operations that provide dynamic scheduling, dispatching, and routing of transit vehicles, and facilitate passenger connection protection and dynamic ridesharing:
  - Dynamic Transit Operations (T-DISP)
  - Connection Protection (T-CONNECT)
  - Dynamic Ridesharing (D-RIDE)
- Begin concept development and needs identification in 2011



# Dynamic Transit Operations

- Dynamic scheduling, dispatching and routing of a vehicle by matching compatible trips
- Traveler provides desired destination & departure time tagged with their current location through personal mobile device
- Considers various modal options, including demand responsive service, fixed-route service and private service, such as taxi
- Considers real-time traffic conditions and vehicle capacity
- May replace some late night or mid-day fixed-route service





# Connection Protection

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- Requires transit inter-modal and inter-agency coordination
- Uses real-time and historical data to examine the arrival status of a transit vehicle and transmits a “hold” message to another vehicle if the lateness falls within a pre-determined threshold
- Transfer requests may be initiated by transit riders
- Monitors the situation and provides connection protection status to travelers

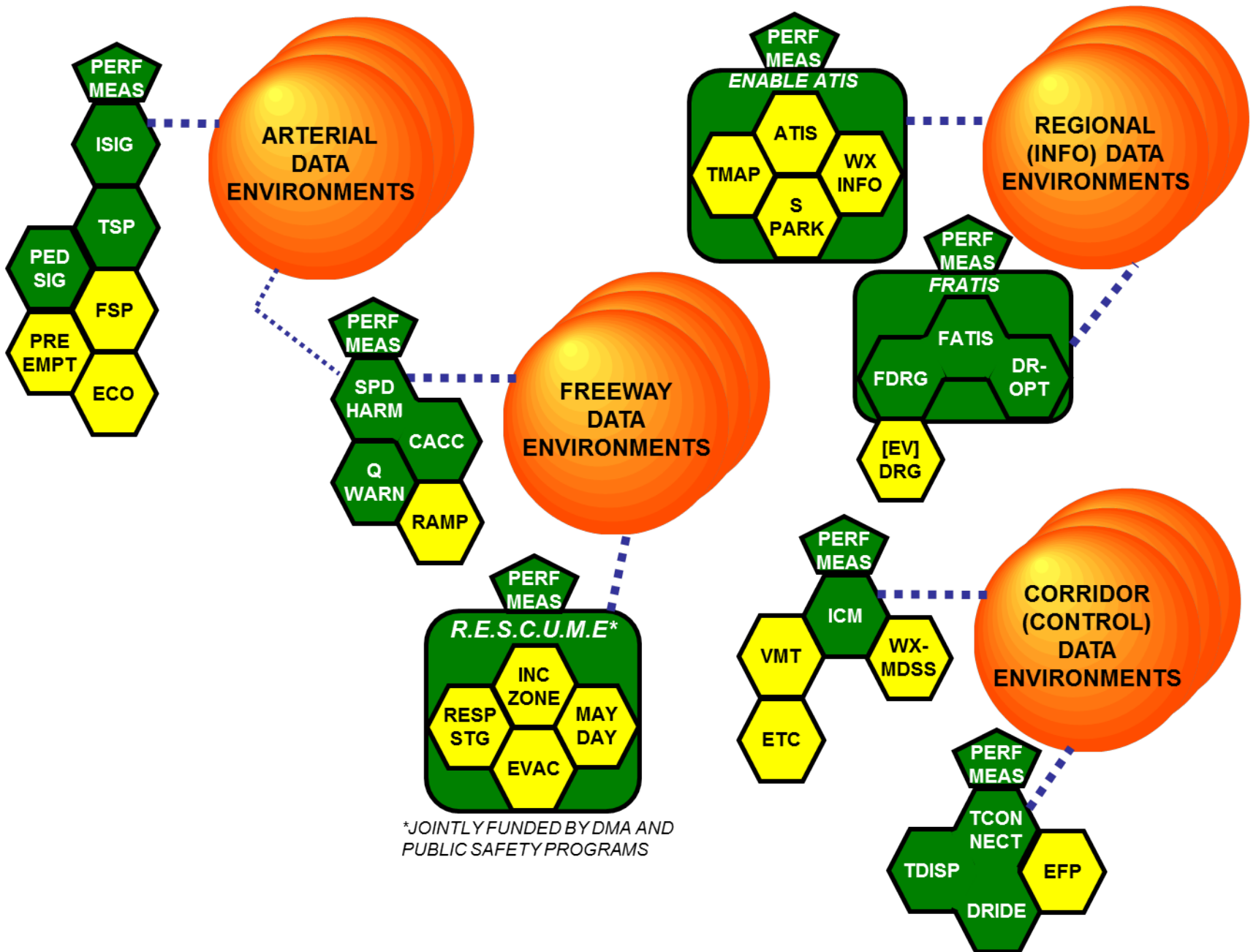


# Dynamic Ridesharing

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- Uses dynamic ridesharing technology, personal mobile devices, and voice activated on-board equipment to match riders and drivers along their route
- Allows trip-by-trip ridesharing (dynamic as opposed to preset carpooling).
- Can take into account individual ridesharing preferences and constraints
- May include technology to verify the number of people in a vehicle for HOV enforcement and toll discounts

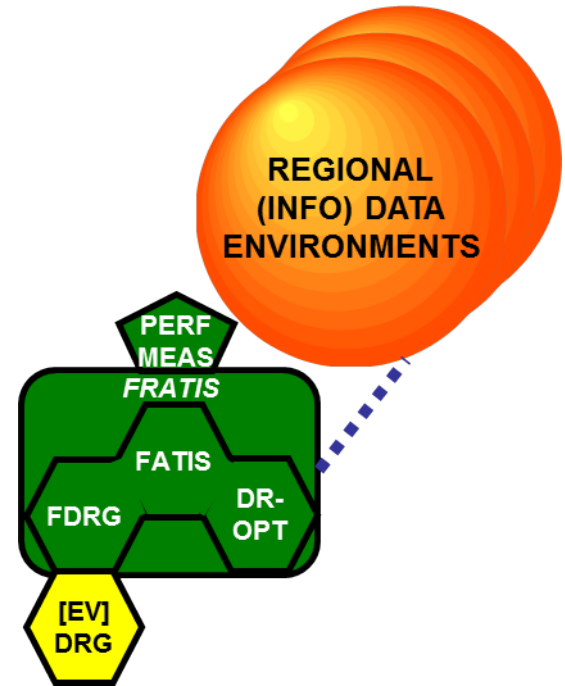




# FRATIS

Randy Butler

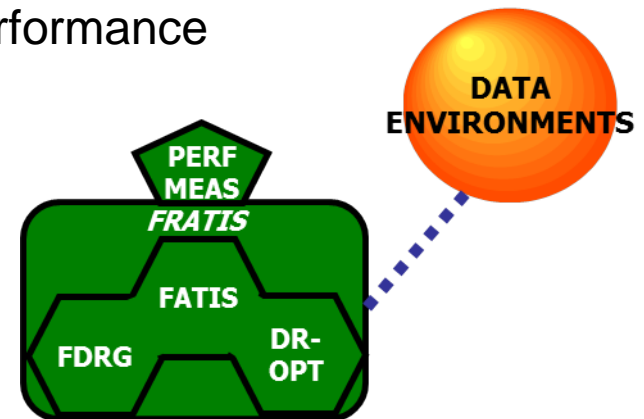
FHWA Freight Operations and Technology



# Freight Advanced Traveler Information System (FRATIS)

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- Freight traveler information system that provides freight-specific route guidance and optimizes drayage operations so that load movements are coordinated between freight facilities to reduce empty-load trips:
  - Freight Real-Time Traveler Information with Performance Monitoring (F-ATIS)
  - Freight Dynamic Route Guidance (F-DRG)
  - Drayage Optimization (DR-OPT)
- Begin concept development and needs identification in 2011



# Freight Real-Time Traveler Information with Performance Monitoring (F-ATIS)

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- Enhances traveler information systems to address specific freight needs
- Provides route guidance to freight facilities, incident alerts, road closures, work zones, routing restrictions (hazmat, oversize/overweight)
- Tailored weather information, regulatory and enforcement information (speed limit reductions), “concierge” services and maintenance locations
- Intermodal connection information, container disposition and schedule
- Performance monitoring



# Freight Dynamic Route Guidance (F-DRG)

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- Addresses negative economic impact on the region by stifling the expansion and entry of logistics operations and logistics-dependent firms.
- Builds on the C-TIP Real Time Traffic Monitoring (RTTM) and Dynamic Route Guidance (DRG) applications for best route between freight facilities.
- Routes calculated on current and predicted conditions



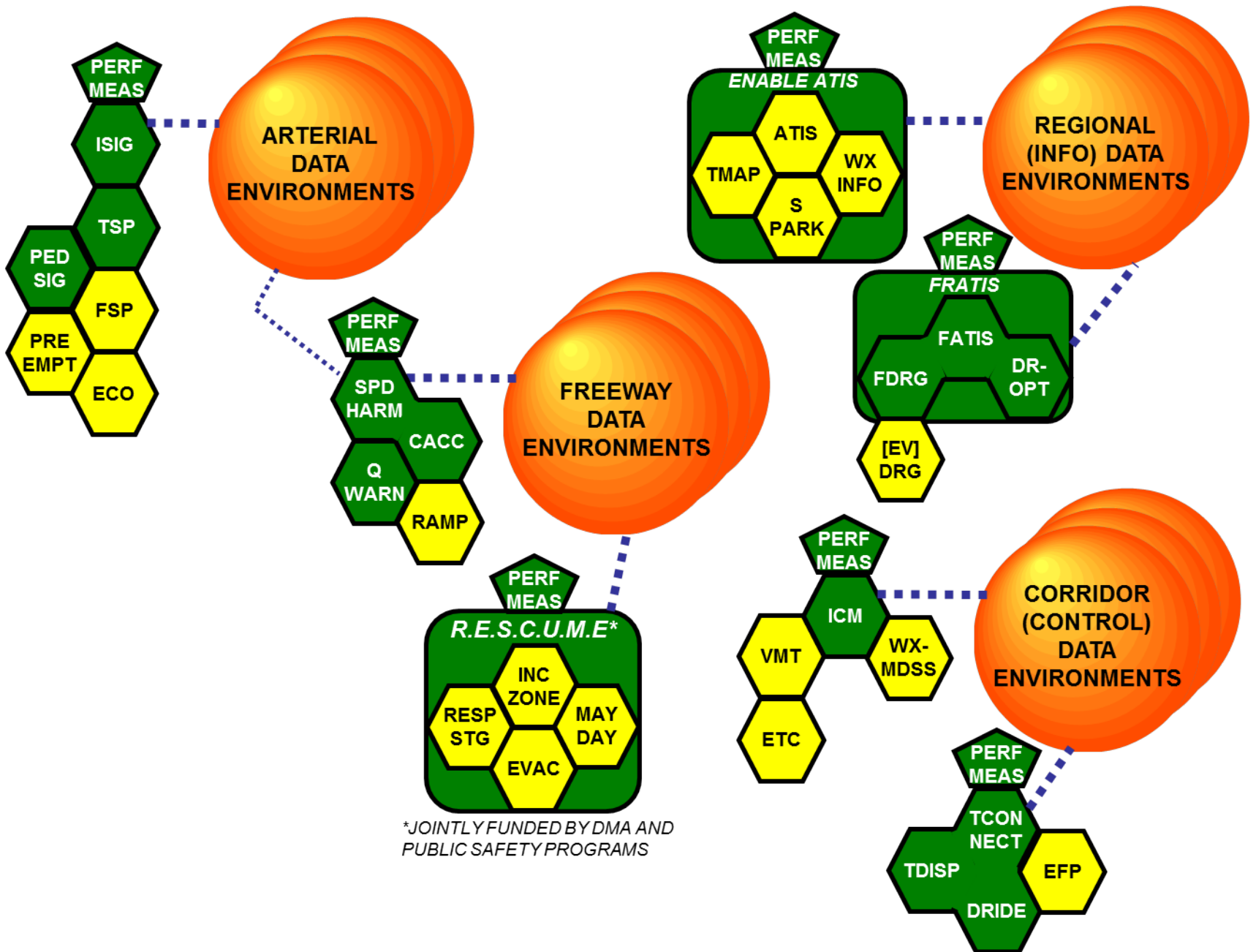
# Drayage Optimization (DR-OPT)

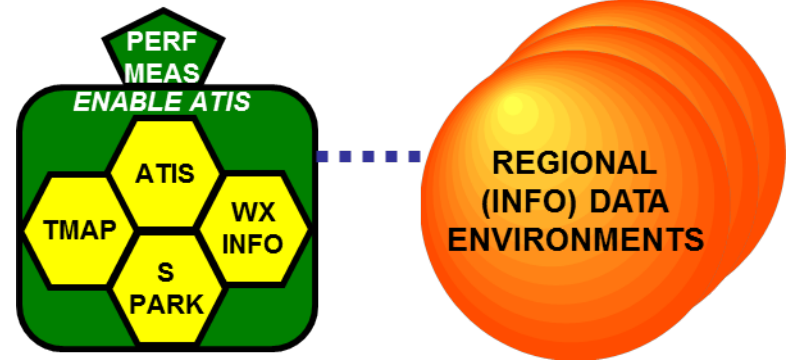
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- Reduces freight delays at key facilities that overbook their capacity to ensure uninterrupted operations within the terminal/warehouse
- Optimize drayage operations so that load movements are coordinated between freight Facilities
- Individual trucks are assigned time windows within which they will be expected to arrive at a pickup or drop-off location
- Early or late arrivals to the facility are dynamically balanced
- Web-based forum for load matching provided to reduce empty moves







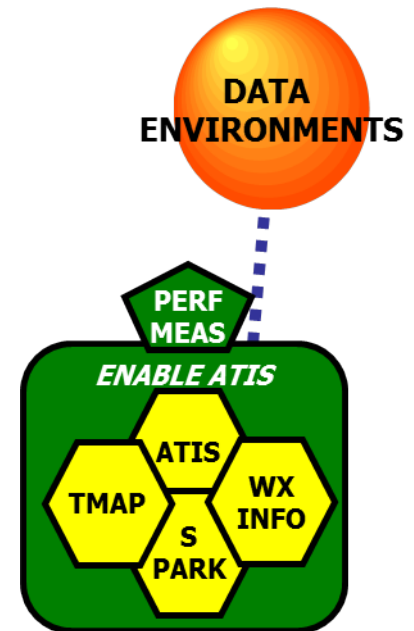


## Enable ATIS

**Bob Rupert**  
FHWA Office of Operations

# Enable Advanced Traveler Information System (Enable ATIS)

- Support the development of advanced traveler information systems that integrate multi-source, multi-modal data, either by ensuring an environment for development or through additional research, prototyping, etc.
  - Multi-Modal Real-Time Traveler Information (ATIS)
  - Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes (WX-INFO)
  - Smart Park and Ride (S-PARK)
  - Universal Map Application (T-MAP)
- Begin vision and concept development for transformational traveler information services in 2011
- Identify appropriate Federal role & next steps



# Multi-Modal Real-Time Traveler Information (ATIS)

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- Leverage market forces to encourage development of accurate real-time multimodal information.
- Integrates real-time reliability and multimodal environment (e.g., auto, transit, bicycle, walk)
- Identify multiple platforms for information dissemination: personal mobile devices, transit stations on vehicle interactive screens, in-vehicle devices, internet, and 511.



# Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes (WX-INFO)

- Provides real-time, highly localized weather information.
- Improves mobility and safety of users of motorized and non-motorized modes of transportation.



- Collects weather-related probe data generated by probe vehicles
- Analyzes and integrates those observations with weather data from traditional weather information sources
- Develops highly localized weather and pavement conditions for specific roadways, pathways, and bikeways.
- Current and forecasted information can be available in-vehicle, and via the internet, variable message signs (VMS), highway advisory road (HAR), 511, and personal communication devices.



# Smart Park and Ride System

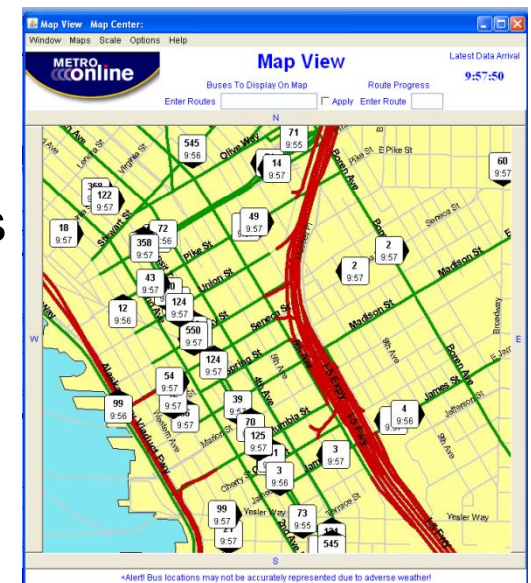
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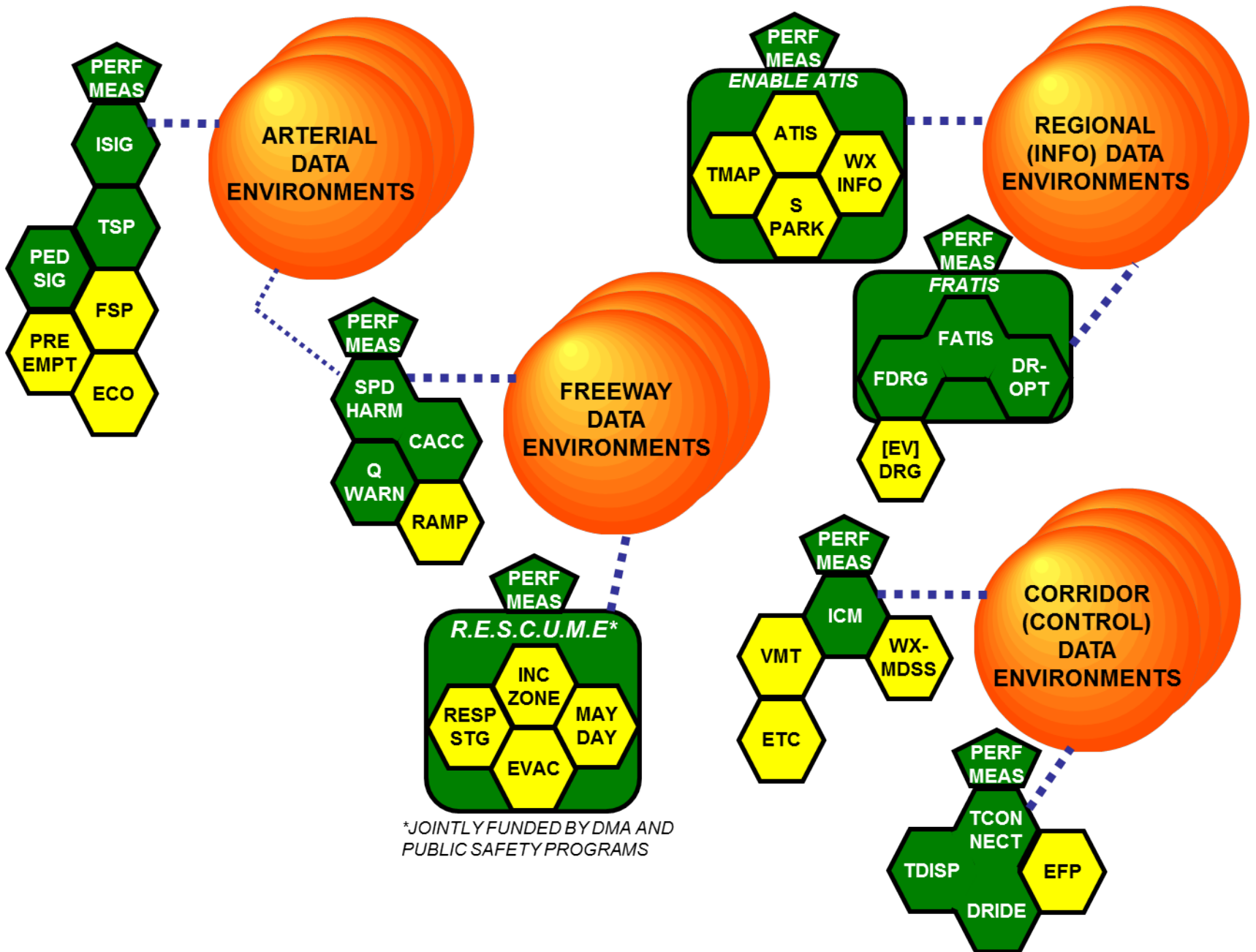
- Monitors the occupancy of parking spaces in real time and provides the information to travelers via personal mobile devices and on-board equipment
- Calculates the average travel distance and time to the parking facility
- If the preferred parking facility is at capacity, the system would suggest an alternative location based on traveler's direction of travel
- May include a reservation system and be integrated with a payment system



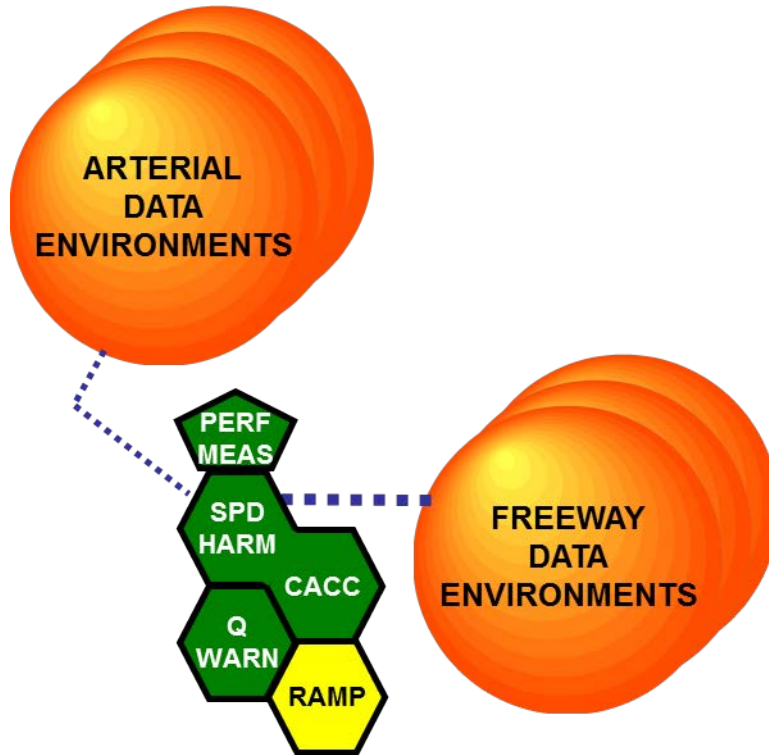
# Universal Map Application

- Allows participating transportation agencies to place real-time information on a universal map, such as:
  - Street closures and detours
  - Traffic flow information
  - Transit vehicle locations
  - Transit service level information
  - Transit amenities
- Addresses issue of proprietary map applications









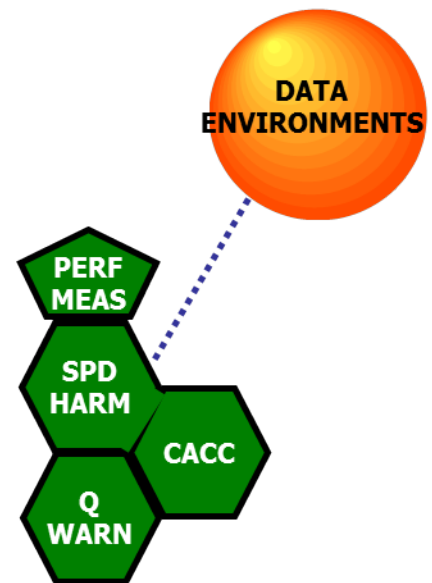
**INFLO**

**Mohammed Yousuf**  
FHWA Office of Operations (R&D)

# Intelligent Network Flow Optimization (INFLO)

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- Network flow optimization application that informs motorists of existing and impending queues and bottlenecks, provides target speeds by location and lane, and allows capability to form *ad hoc* platoons of uniform speed:
  - Queue Warning (Q-WARN)
  - Dynamic Speed harmonization (SPD-HARM)
  - Cooperative Adaptive Cruise Control (CACC)
- Begin concept development and needs identification in 2011



# Queue Warning (Q-WARN)

- Warns motorists of existing or imminent downstream queues or shockwaves to increase safety by reducing rear-end collisions and preventing dangerous and late-stage lane-changing.
- Provides early congestion warnings to motorists, improve throughput, and reduce delays by allowing them to take alternate routes or change lanes.
- May be applicable to freeways, arterials, and rural roads.



# Dynamic Speed Harmonization (SPD-HARM)

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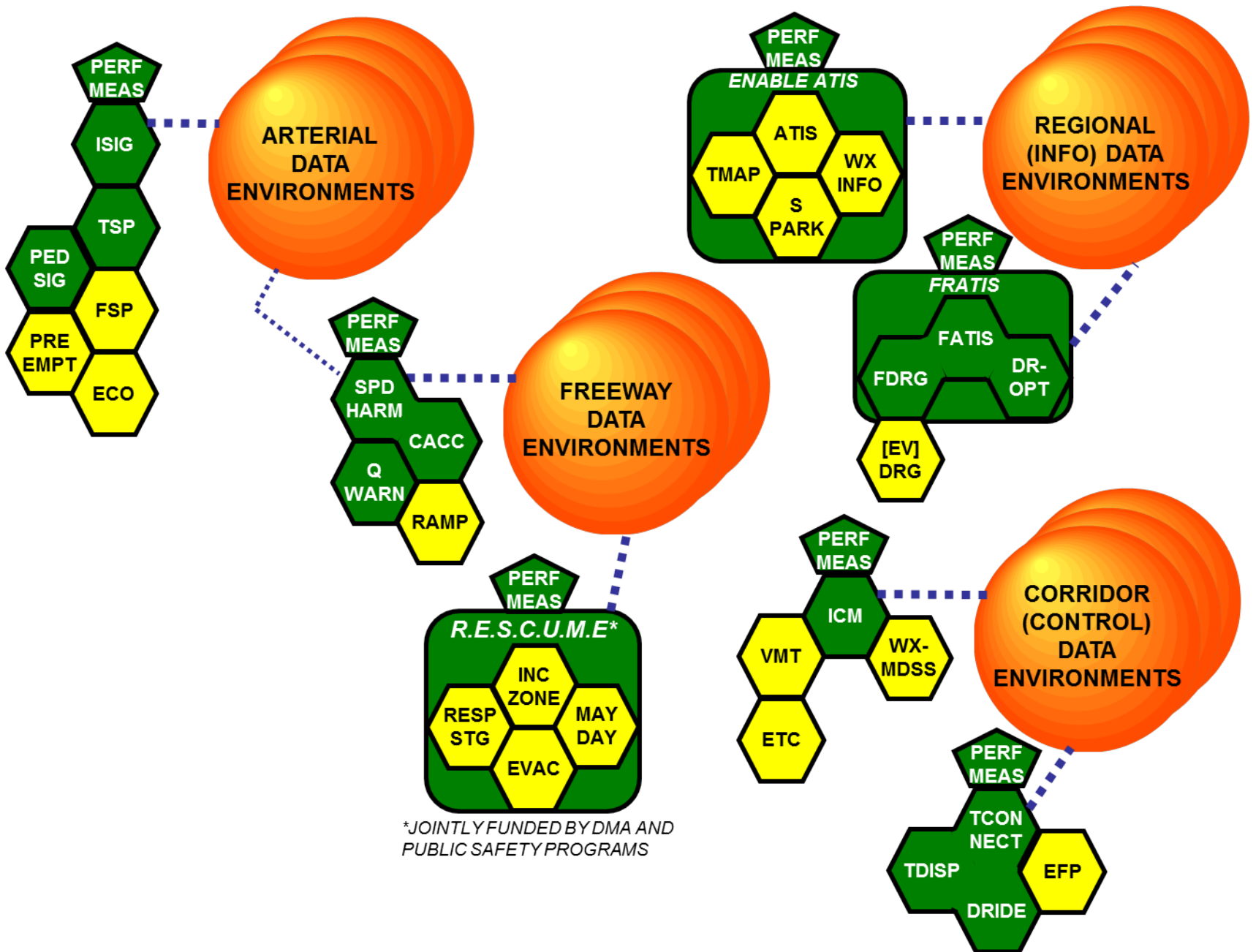
- Monitors traffic and weather data captured from multiple sources, and calculate a target speed for vehicles.
- Target speeds may be advisory or enforced, and may vary by location (e.g., distance upstream of a recurrent bottleneck), and by lane.
- Provision of target speeds can be initiated when detected congestion exceeds a pre-defined threshold or when congestion is impending.
- Applicable to freeways and arterials.

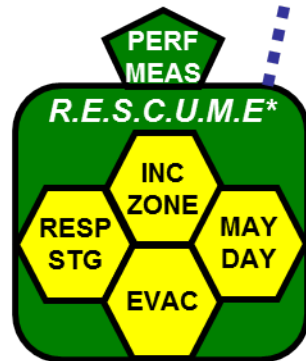


# Cooperative Adaptive Cruise Control (CACC)

- Informs motorists of location, speed, and acceleration, of leading vehicles allowing the follower to safely follow the leader at a shorter gap.
- Motorists can safely and quickly respond to speed changes by the leading vehicles thereby reducing the risk of rear-end collisions
- Can be implemented as vehicle to vehicle, infrastructure to vehicle or *Ad hoc* platooning
- Applicable to freeways and arterials.







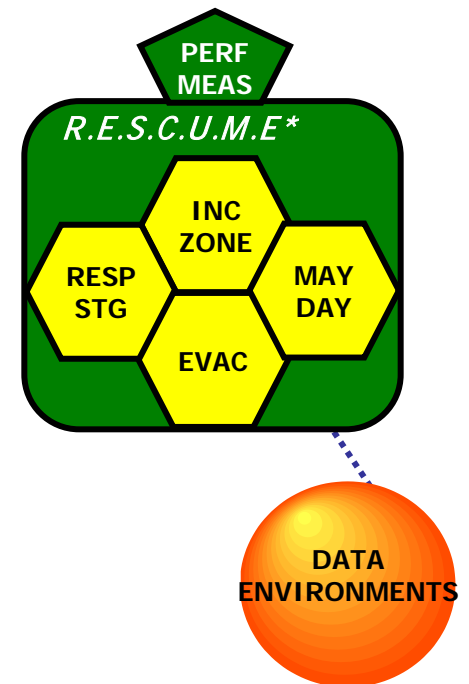
**R.E.S.C.U.M.E.**

**Linda Dodge**  
**RITA JPO**

*\*JOINTLY FUNDED BY DMA AND  
PUBLIC SAFETY PROGRAMS*

# Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)

- Advanced vehicle-to-vehicle safety messaging over DSRC to improve safety of emergency responders and travelers:
  - Emergency Communications and Evacuation (EVAC)
  - Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)
  - Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)
  - Mayday Relay (MAYDAY)
- Begin concept development and needs identification in 2011





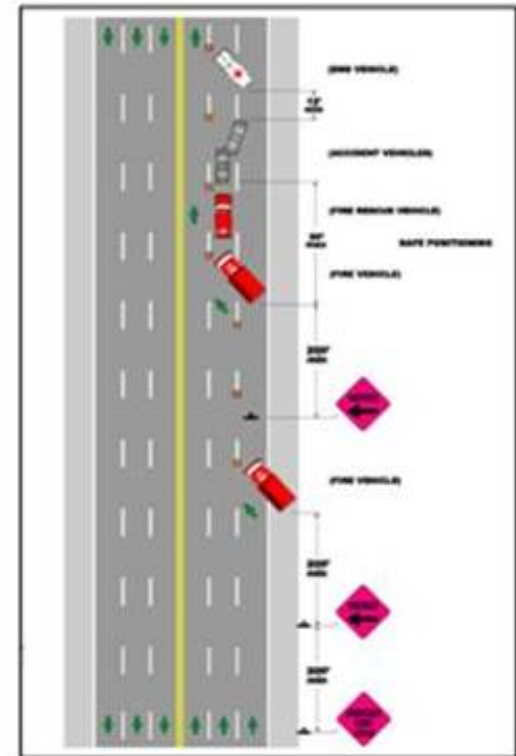
# Emergency Communication and Evacuation

- Addresses the needs of two different evacuee groups:
  - Those using their own transportation
    - Dynamic route guidance information,
    - Current traffic and road conditions,
    - Location of available lodging, and
    - Location of fuel, food, water, cash machines and other necessitates
  - Those requiring assistance
    - Identify and locate people who are more likely to require guidance and assistance
    - Identifies existing service providers and other available resources



# Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)

- Situational awareness to public safety responders while enroute to establish safer incident work zones
- Valuable input to responder and dispatcher decisions and actions
- Range of data to responders through mobile devices to help support public safety responder vehicle routing, staging and secondary dispatch decision-making, including:
  - Staging plans
  - Satellite imagery
  - GIS data
  - Current weather data
  - Real-time modeling outputs



Source: Oconto County, WI



# Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)

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- Two components
  - Alerts and warns drivers of lane closings and unsafe speeds for the temporary work zones
    - Could ultimately be augmented with the provision of merging and speed guidance to drivers.
- Warns on-scene workers of vehicles with trajectories or speeds that pose a high risk to their safety
  - Workers in the zone (e.g., law enforcement) could then be warned of the risk via an audible warning that is delivered via earpiece or some other device



Source: John Bodie

# Mayday Relay (MAYDAY)

- When an enabled vehicle is involved in a crash, this application will automatically send a mayday message. When a passing enabled vehicle receives the mayday message, it will deliver it to a roadside hot spot
- This information will then be relayed to the appropriate PSAP based on the crash location.



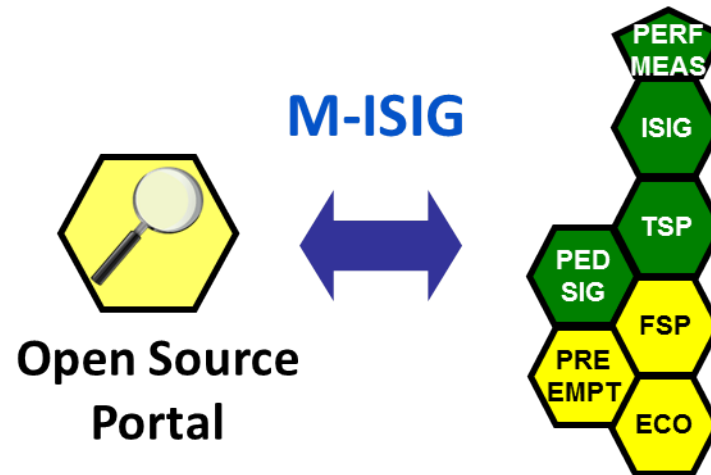
Source: Greg Carter Herald Sun

# DMA Program Next Steps

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Kate Hartman  
ITS-JPO

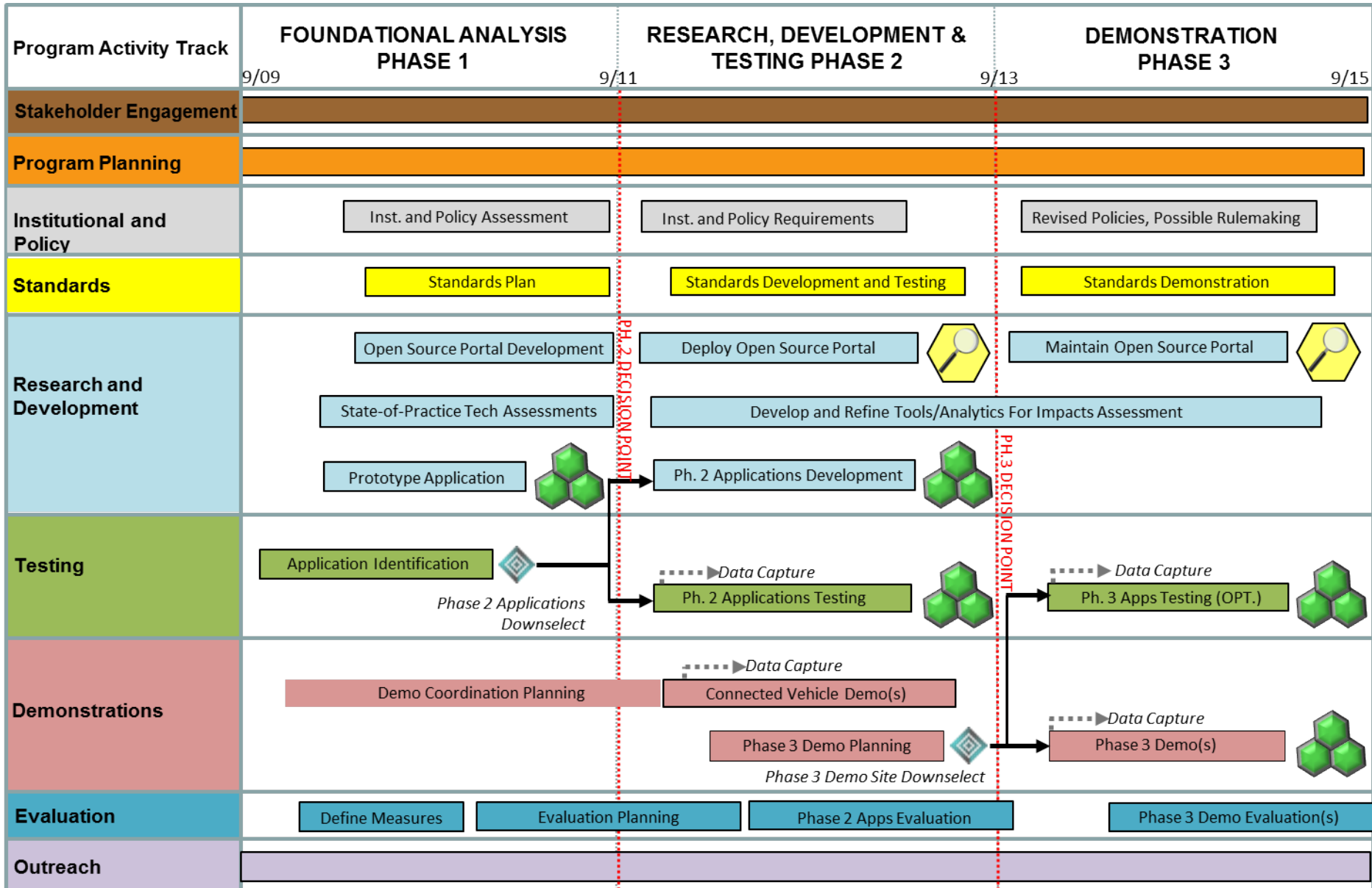
# Create an Open Source Applications Portal



- **Purpose:** Develop, operate, and maintain an open source portal that will enable multiple stakeholders to collaborate on application development
- **Coordination:** Application bundles require concurrent, collaborative development
  - E.g., in the M-ISIG bundle, pedestrian signal phases in the PED-SIG application must be coordinated with applications providing priority or pre-emption services
  - This coordination extends to both DMA-funded application development and research conducted at UTCs, other organizations
- **Transparency:** the Open Source Portal provides the mechanism to ensure application development is transparent and broadly available



# Dynamic Mobility Applications Program Roadmap



Do the candidate applications show enough promise to be tested?  
 Do these applications address key performance measures?  
 Do we understand the communications requirements of these applications?

Are there clear and compelling arguments for deployments showing significant benefits?

**LEGEND** Decision point

Program Activity

Data Capture  
 Data Feed

Open Source Applications

Open Source Portal

# Dynamic Mobility Applications Program Status and Next Steps

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- High priority mobility applications identified
- Open Source Application Development Portal under development
- Develop and release in open data/open source environment a performance measurement application to prototype open source application development effort
- Begin assessing capability of analytical tools to evaluate bundle applications
- Begin concept development and needs identification for high priority bundles



# For More Information ...

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## *M-ISIG*

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