Government-Industry Cooperation to Develop Performance Requirements, Objective Test Procedures and Benefits Estimation for Crash Imminent Braking Systems and Advanced Restraint Systems

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On Behalf of the
Crash Avoidance Metrics Partnership (CAMP)

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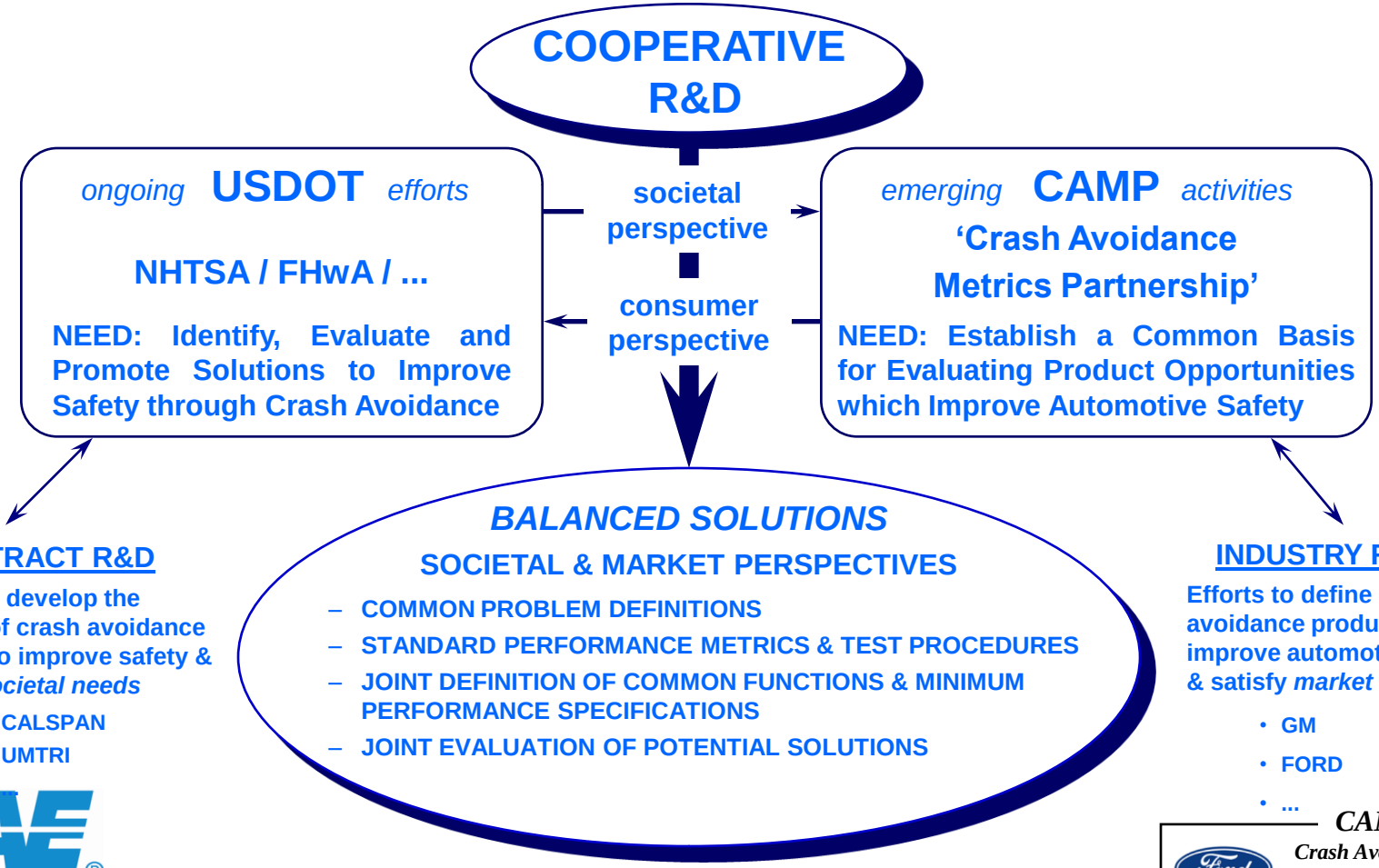
Crash Avoidance Metrics Partnership (CAMP)

CAMP provides an OEM oriented administrative shell under which various stakeholders can collaborate on pre-competitive crash avoidance research projects of mutual interest

Working Cooperatively

CAMP's goal is to facilitate industry consensus on what future crash avoidance countermeasure systems should do and how to test them. Conducting cooperative research with USDOT balances perspectives and leverages resources to address common needs.



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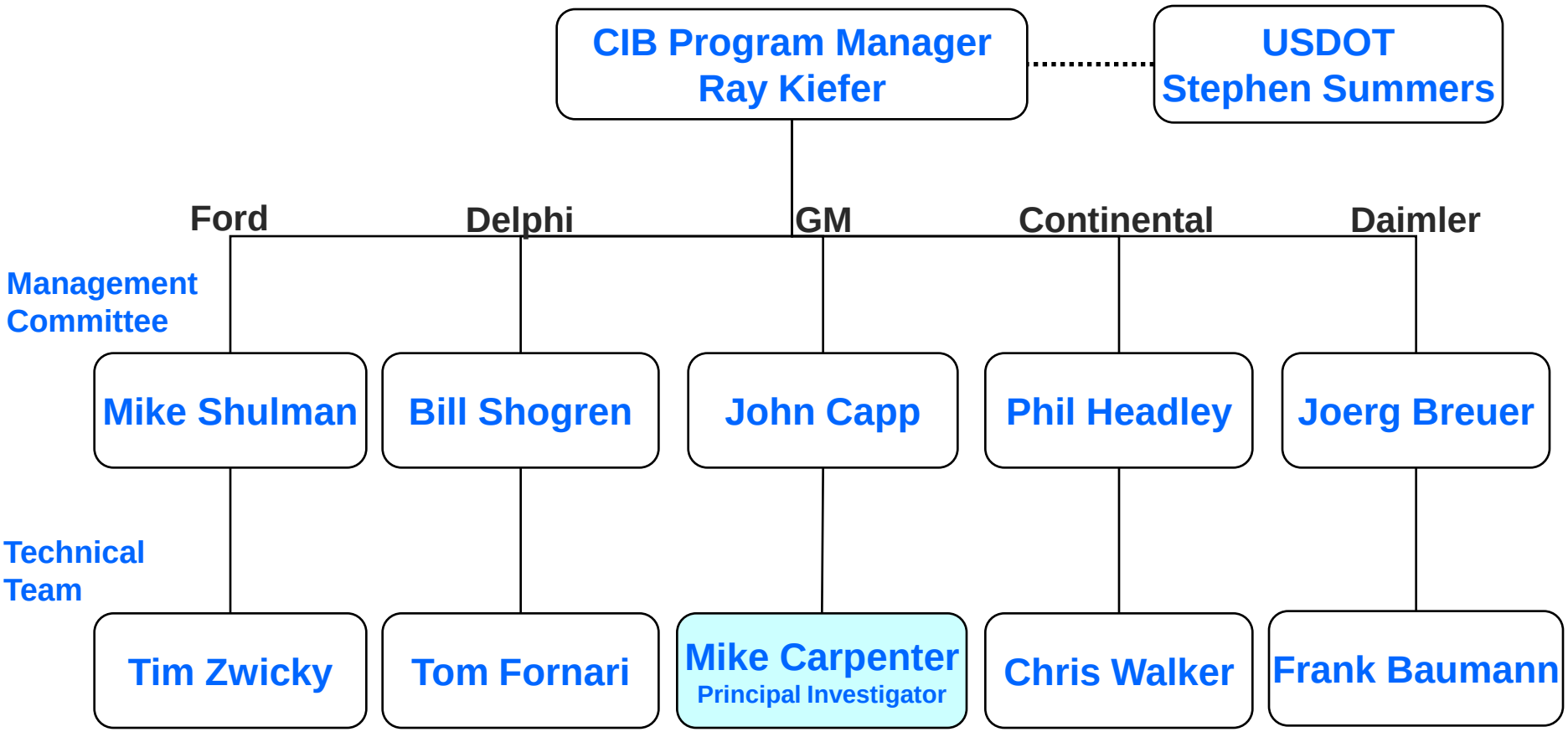
The Crash Imminent Braking (CIB) Consortium



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Crash Imminent Braking (CIB) Project Objectives

Objectives:

- Develop and validate performance requirements and objective tests for imminent crash automatic braking systems that may improve the safety of the U.S. light vehicle fleet
- Develop a CIB benefits estimation methodology based upon injury risk data and test results from prototype CIB systems

Key Aspects of Project:

- OEM and supplier participating team members
- Multiple USDOT agencies and offices
- Interdependent collaboration throughout the project
- Prototype CIB systems used for test method development, not further development of the technology

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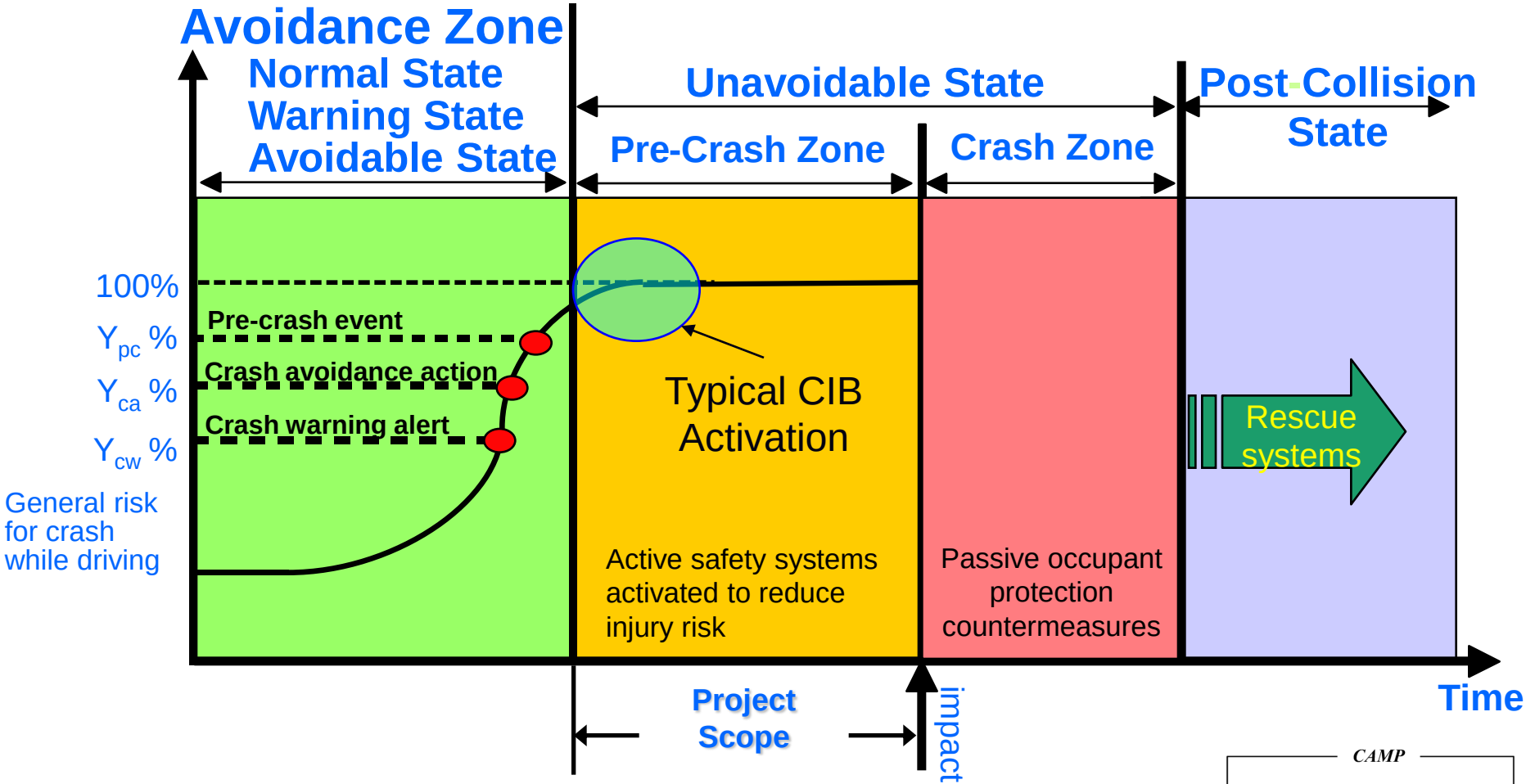
CIB Initial Tasks
(Tasks 2-5)

- Scope project based on field data and pre-crash events for crashes leading to severe injuries
  - Field Crash Databases
  - Previous NHTSA Field Operational Test Databases
  - VOLPE Studies
- Develop Preliminary Functional Requirements
- Identify existing and near-term technologies
  - Identify abilities to address selected crash events
  - Identify capability limitations for particular events

Critical Event Timeline



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Influence of CIB Systems

Crash Imminent Braking Measure

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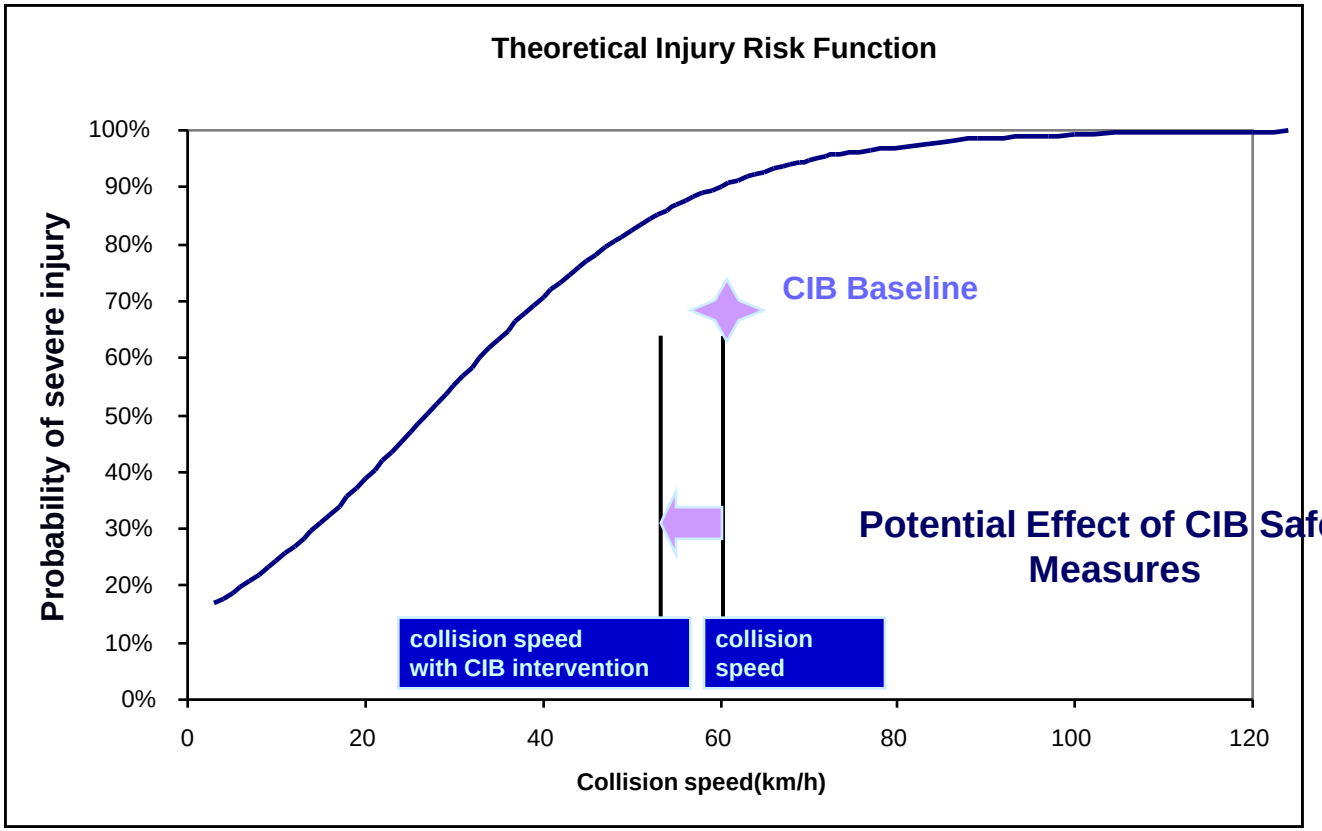
Expect Reduced Collision Speed and Resulting Reduction on Injury Risk



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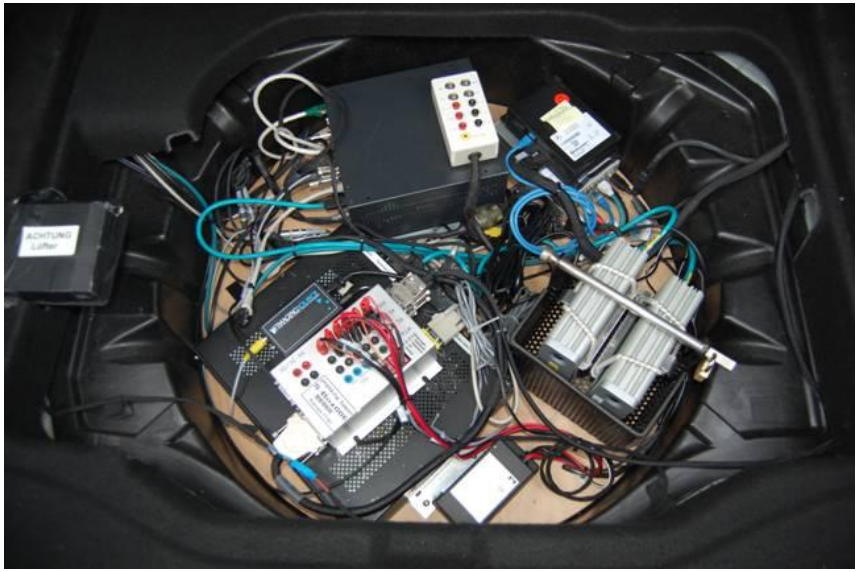
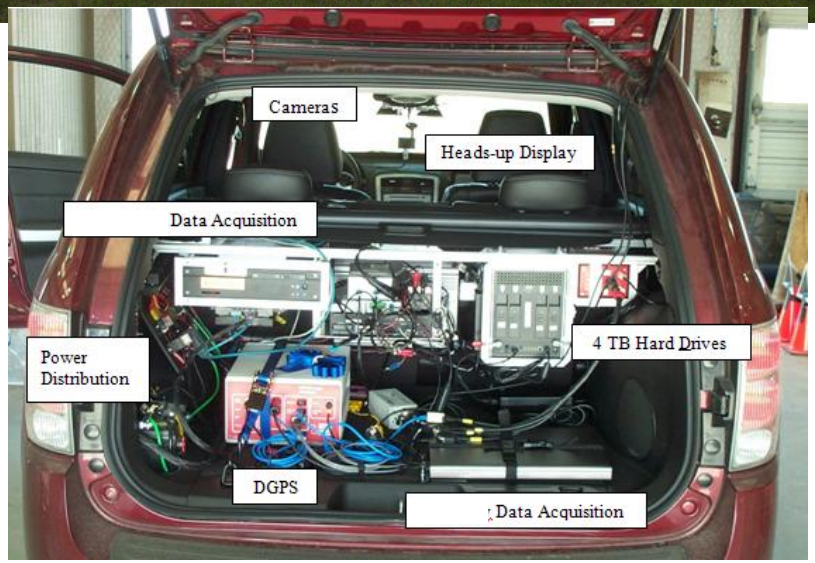
Project Test Vehicles
Task 6

- Purpose of test vehicles is to simulate the capabilities of various CIB systems for the development of comprehensive test procedures
- Vehicles simulate numerous possible CIB configurations
- Each vehicle includes:
  - Various sensor arrays based on results from Tasks 3 – 5
  - Brake controllers with adjustable parameters
  - System controls capable of supporting varying configurations

CIB Test Vehicles





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Test Plans
Tasks 7-9

Functional

- Test methods capable of emulating selected crash scenarios and pre-crash events
- Test methods capable of differentiating levels of system performance
- NHTSA verification tests w/ existing systems
  - Confirm prototype system settings
  - Provide baseline for system tests
  - Confirm test parameters ("Test the Test")

Operational

- Generate a real-world data set capable of estimating rates of occurrence of false activations
- Provide capability for additional simulations (Monte Carlo Analysis) based on various PIP system settings using the real-world data set
- Test track methods capable of detecting occurrences of false or unintended activations

Functional & Operational Test Sets

Probability of Action		System Action Taken as Designed	
		Yes	No
Object of Interest Present and In Path	Yes		Missed Action
	No	False Action	

- Assess the system performance in regard to intended actions
  - Performs the Design Intent Action when a valid target is in path
- Assess the system performance in regard to unintended actions
  - Falsely activates when there is NOT a valid target in path
  - Does too little to meet the minimum performance level
  - Takes an action that is a Nuisance

Finalization of System Benefits
Task 10

- Summarize test results for reduction of impact velocity
- NHTSA and Volpe to define a benefits estimation method for determining harm reduction with and without CIB systems
- CIB Consortium, NHTSA and Volpe working toward estimating benefits and effectiveness of tested CIB system configurations

Advanced Restraint Systems (ARS) Project

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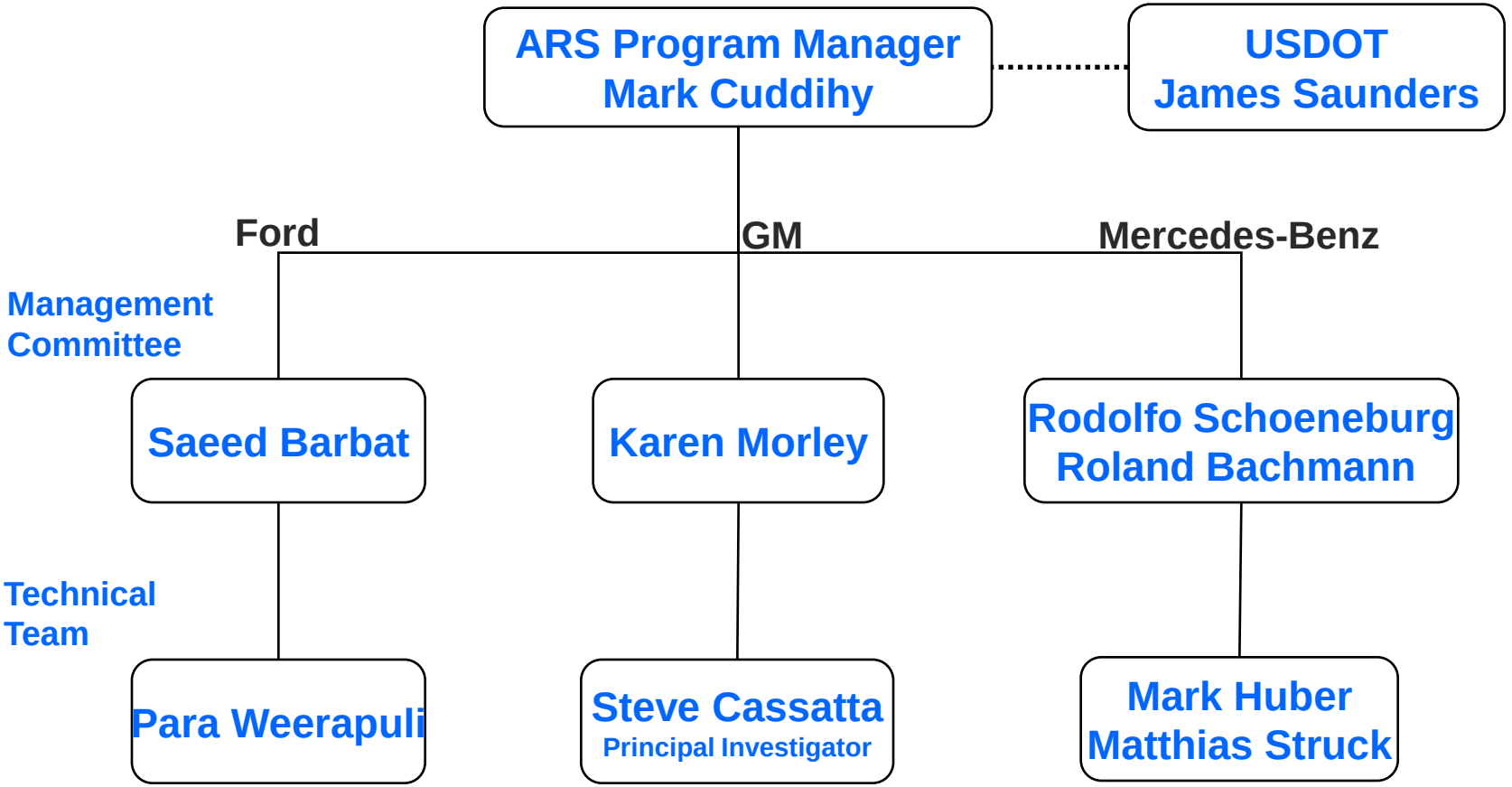
The ARS Consortium



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ARS Project
Objectives and Deliverables

Objectives:

- To develop and validate minimum performance requirements and objective test procedures for advanced restraint systems that appear to provide an opportunity to reduce the societal harm resulting from motor vehicle crashes in the US light vehicle fleet
- To identify and fabricate the most promising prototype advanced restraint systems and complete test and evaluation
- To develop preliminary estimates of potential benefits of prototype advanced restraint systems

Deliverables:

- Minimum performance specifications for ARS systems
- Test procedures for evaluating ARS systems
- Methodology for estimating system benefits

ARS Project Overview

- Task 1 is the project management task which runs throughout the project
- Task 2 focused on analysis of field databases to identify and understand the crash scenarios where serious injuries occur
  - Top-down statistical analysis
  - Bottom-up case reviews (detailed)
  - Cooperation from NHTSA and Volpe in task execution

Evaluation of Advanced Restraint Technologies and Definition of Crash Modes (Tasks 3-5)

- Conducted a survey of suppliers regarding near-term advanced restraint technologies with the potential to address injury modes observed in field data
- Used Pugh analysis to evaluate restraint technology to select components and systems for use later in the project (i.e., test method development, test data for benefits estimation)
  - Performed component level and system level assessment to rank options
  - Focus was restraint systems for driver and front seat passenger
- Identified two crash modes (one V-V and one V-O) for further study within the ARS project
  - Based on Computer Aided Engineering (CAE) analysis of the occupant responses of a 50th percentile driver

Development of the Advanced Restraint System (Tasks 6-7)

- These tasks involve activities for refining the advanced restraint system selected for the project in preparation for tests conducted in Task 8
- Component level development is contained within Task 6
  - Initial work featured component testing to provide data for CAE model development
- System level CAE analysis is featured in Task 7
  - Component and system level models were prepared
  - Models are currently being correlated to test data

Testing of Advanced Restraint System (Task 8)

- Testing activities include both HYGE sled and vehicle crash tests
- The two selected project crash modes (i.e., V-V and V-O) will be simulated during tests
- Two types of vehicle testing will be conducted:
  - Baseline vehicle tests to establish initial injury metrics
  - Final vehicle tests with the advanced restraint system to:
    - Establish final injury metrics for benefits estimation
    - Verify and demonstrate the test methods developed

Finalization of Benefit Estimates (Task 9)

- Summarize test results from prior tasks
- Document the principal outputs from the project:
  - Final set of test procedures for evaluating advanced restraint systems
  - Minimum performance specifications for advanced restraint systems
- ARS Consortium, NHTSA and Volpe are working toward estimating system benefits and effectiveness of tested advanced restraint system