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Advances And Vision In Active Road Safety Systems In The USA

3rd Conference on Intelligent Transportation Systems in Israel

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Presentation Topics

- Safety Challenge
- Major Programs
  - Integrated Vehicle Based Safety Systems
  - Vehicle Infrastructure Integration
  - Cooperative Intersection Collision Avoidance Systems

Safety Challenge in the U.S.

- 6 Million Crashes/Year Result In
  - 42,000 fatalities/year
  - Direct Costs - $230.6 Billion/year
  - 25% of all congestion due to crashes
- Significant Progress Has Been Made In The Area Of Crash Worthiness
- Some Limited Progress On Active Crash Avoidance
- New Technologies Offer The Potential To Dramatically Reduce Crashes
  - Improved and Integrated Autonomous Systems
  - Cooperative Systems
- U.S. DOT Actively Pursuing These Systems

Integrated Vehicle Based Safety Systems (IVBSS)

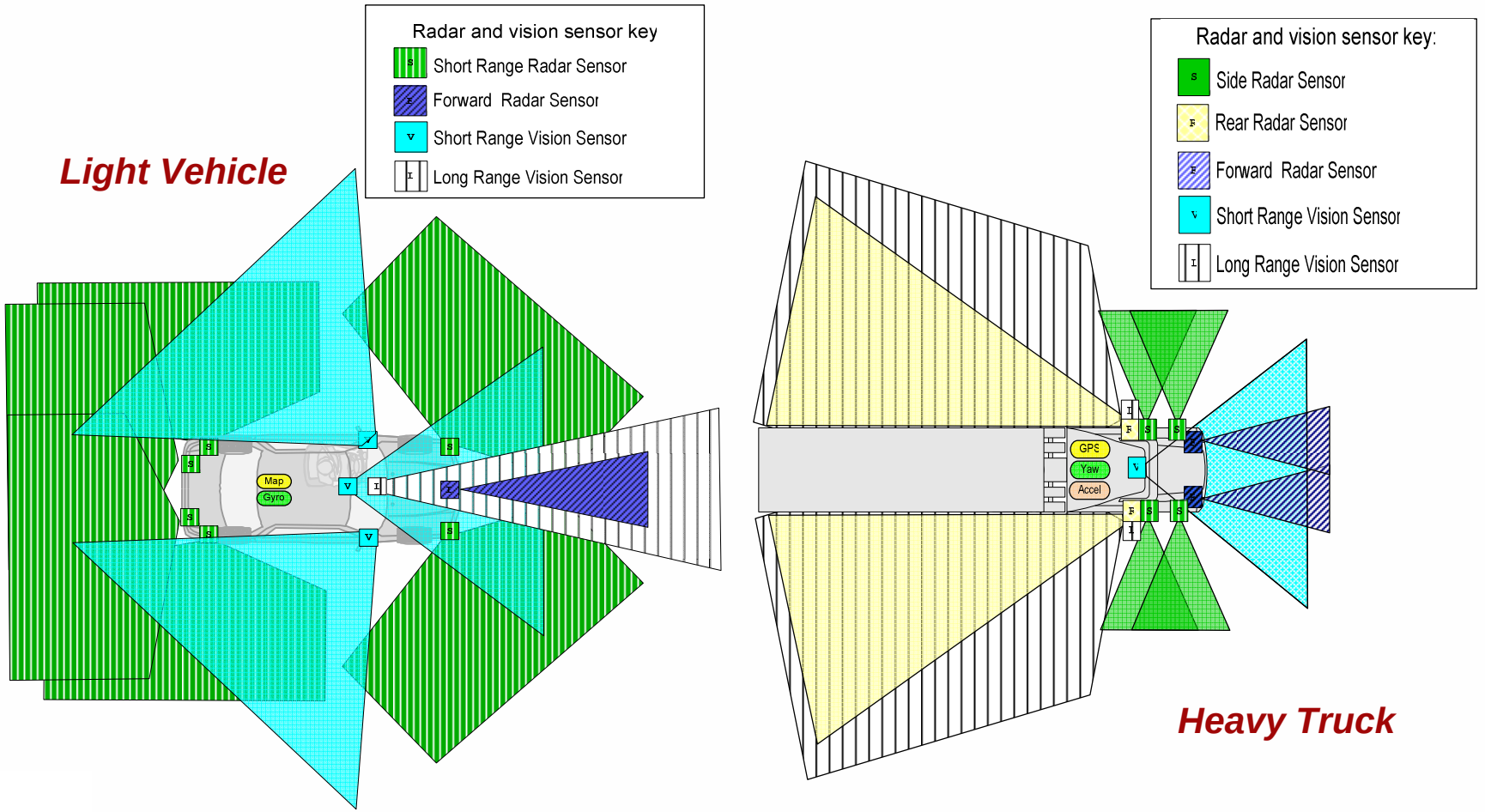
IVBSS Program Framework

- Vision
  - All New Vehicles Would Be Equipped With Integrated Driver Assistance Systems That Help Drivers Avoid The Most Common Types Of Crashes:
- Background
  - Builds On Development Of Existing Crash Avoidance Technologies
- Approach
  - Develop Technology-independent Performance Guidelines
  - Build And Test Prototype Vehicles Meeting These Guidelines
  - Determine Driver/Operator Acceptance And Real-world System Effectiveness.

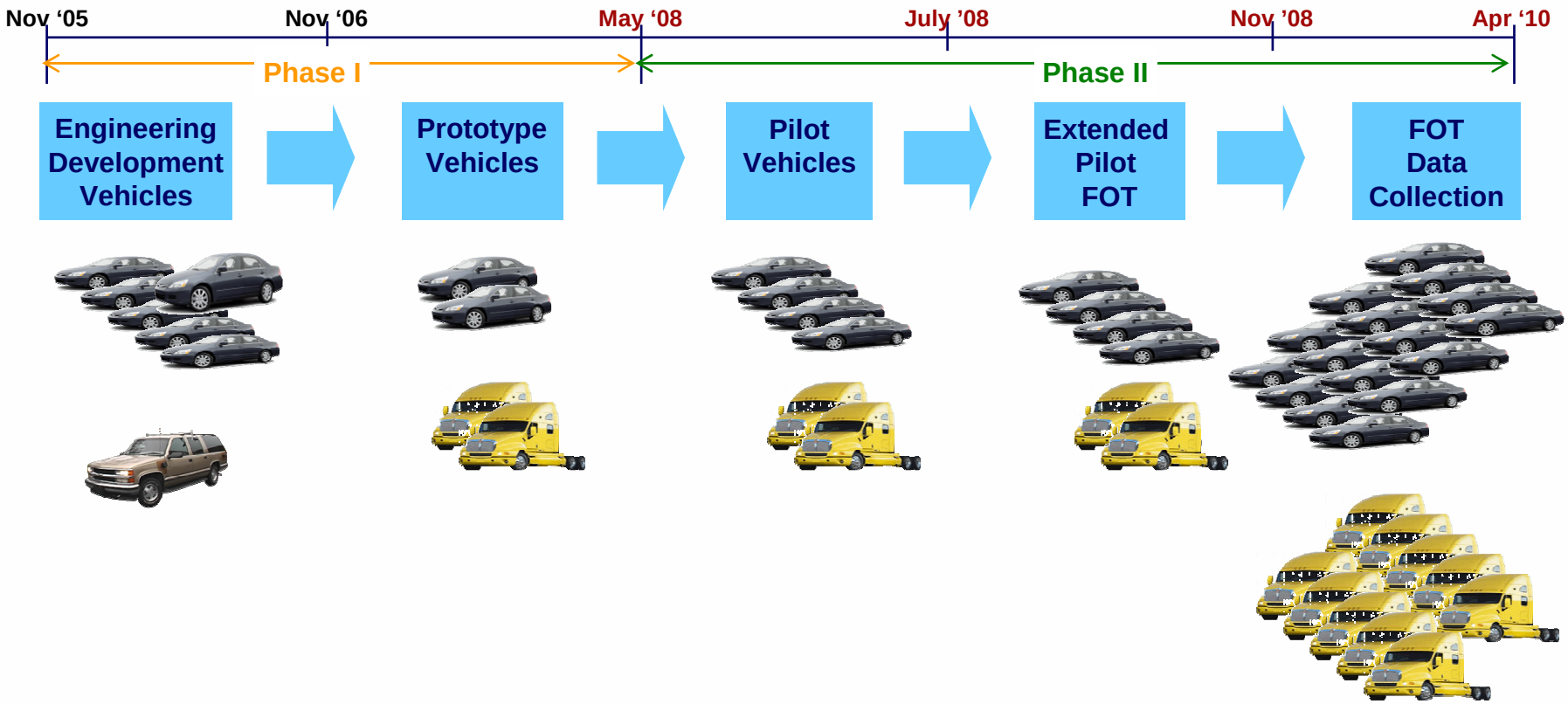
How does IVBSS work?

- Integrated Systems Would Combine Features Of Three Currently Available Crash Avoidance Systems
  - Rear-end
  - Road Departure
  - Lane Change/Merge
- The Integrated System Detects Crash Threats
  - Long- And Short-range Radar & Vision
  - GPS/Map Matching
  - Other Vehicle-level Signals
  - Sensor Data Is Integrated For Threat Detection
- Driver Is Informed Of Threat Via A Driver Vehicle Interface (DVI)

Integrated System Sensor Coverage



Program Timing and Vehicle Builds



Field Operational Test

- The FOT Data Collection
  - One Year
  - Cars (10): Normal Drivers In Regular Use
  - Trucks (20): Fleet User (Conway)
- Vehicles Have Onboard Systems To Collect Sensor Data
  - Driver Behavior And Driving Conditions Documented With Video
- Partners And Independent Evaluator Analyze Data And Determine Safety Benefits
- FOT Will Evaluate Both System And DVI Performance

Safety/Human Factors Research Issues

- Multiple Threats And Prioritization Of Warnings
  - How To Prioritize?
  - How To Present To Get Optimal Response?
- Non-useful Warnings
  - False Alarms – How Many Are Acceptable?
  - Nuisance Warnings
    - E.G Object Detected, But Road Curves Away From It
    - E.G. Warns Driver Of Already-known Vehicle
  - Premature And Weather Triggered Warnings

Overall Status

- Schedule:
  - Phase I Completed
  - Phase II Underway
- Performance:
  - LV System Performance Meets Requirements
  - HV System Performance Meets Requirements

Vehicle Infrastructure Integration (VII)

VII Program Framework

- Vision: The Establishment Of Vehicle To Vehicle And Vehicle To Roadside Communication Capability Nationwide
- Purpose: To Enable A Number Of New Services That Provide Significant Safety, Mobility, And Commercial Benefits
- Objective: To Determine The Feasibility (Technical, Economic, Social/Political) Of Deploying VII
- Milestone: A Deployment Strategy For VII

VII Can Enable a Wide Range of Applications

- Cooperative Safety Systems
  - Electronic Brake Light Assist
  - Intersection Collision Avoidance
  - Road Departure Warning
  - In-vehicle Signing
  - Wireless Vehicle Inspections
- Active Probe Vehicles
- Highway Financing
- Commercial Applications

Concept of VII

Driver

Driver Interface

Vehicle Data

End User

On Board Unit

Subscriber Applications

5.9 DSRC

On Board Unit

Road Side Unit

Network

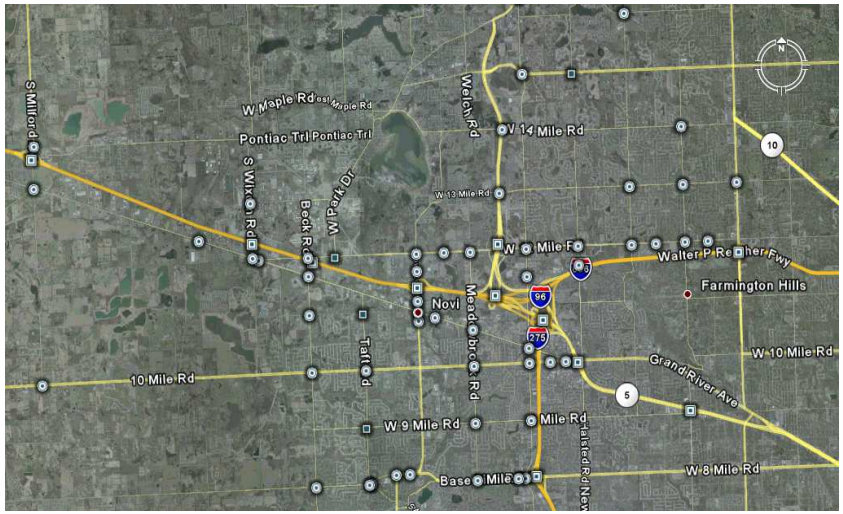
Issues Effecting Deployment

Several Key Issues Will Have to Be Resolved:

- Technical Implementation
- Institutional Issues
- Business Models/Deployment Strategies

VII Development and Test Environment

- Detroit, Michigan Metropolitan Area
- Proof of Concept (POC) Testing and Application Integration
- 60 RSEs – 30+ DSRC Equipped Vehicles
- POC Applications
  - Collision Avoidance
  - Electronic Brake Warning
  - Traveler Information
  - Electronic Payment
  - Weather Information
  - Roadway Maintenance



POC Test Results

- POC Testing To Date Indicates That The Majority Of The Original Technical Viability Criteria Can Be Met With The Current Architecture.
- Changes To The Standards And Technical Enhancements Will Be Required.
- To Date, The Development And Test Teams Have Found No Major Technical Obstacles To Deployment Of The VII System Concept As Original Envisioned.

Institutional Issues

- Privacy Policies Framework
  - Privacy Principles
  - Privacy Limits
- Liability
- Governance

Business Issues

- How VII Gets Deployed
- Who Pays
- How Is VII Managed Over The Long Term
- Tentative Conclusions
  - A Market Driven Deployment Not Feasible
  - National Deployment Required
  - A Business Entity Is Needed To Manage VII
- Options
  - Public Sector Model
    - Federal Funding,
    - Government Deployed And Operated
  - Private Sector Model
    - Revenue Stream
    - Public Sector Applications

Future Activities

- Safetrip-21 Operational Field Test
- Next Phases
  - Research In The Areas Of Enabling Technology, Institutional Issues, And Applications To Support Deployment
  - V-V Safety Application Development
  - Monitoring And Assessing Future Technologies For Reducing Costs And Enhancing System Performance.

Cooperative Intersection Collision Avoidance Systems (CICAS)

CICAS Program Framework

- Goal: To Significantly Reduce The Number And Severity Of Intersection Related Crashes
- Background:
  - Every Year At Intersections:
    - 9,500 Fatalities
    - 1.3 Million Injuries
    - 2.6 Million Crashes
    - $97 Billion (Comprehensive Cost)
- Objectives:
  - To Develop And Demonstrate The Effectiveness Of Cooperative Intersection Collision Avoidance Systems
  - To Assess The Value And Acceptance Of Cooperative Collision Avoidance Systems
  - To Develop And Provide Tools To Support Industry Deployments

CICAS Crossing Path Scenarios

- A Subset Of The Overall Intersection Problem, That Includes:
- Violation Warning
  - Traffic Signal
  - Stop Sign
- Safe Gap Assessment
  - Stop Sign Assist (SSA)
  - Signalized Left Turn Assist (SLTA)

Violations Warning Program Elements

- Primary Focus Of CICAS Program
- To Determine The Optimal Warning System (Type And Timing) And Quantify Effectiveness In Preventing Crashes
- Major Products
  - Performance Specs/Objective Test Procedures
  - Prototype System For Field Testing
  - Field Test Results On Effectiveness, User Acceptance, And Unintended Consequences

Status

- Performance Specifications Developed
- Prototype System Developed And Tested
- Full Scale Field Operational Test Being Reconsidered
  - Integrate Into Future Vii Field Tests

CICAS Stop Sign Assist Program Elements and Status

- Prototype System Has Been Installed At Test Intersection
- Objective Testing Is On-going
- Approximately 60 People From The Local Area Will Drive Through The Intersection In An "Equipped" Vehicle
- Driver Behavior And User Acceptance Will Be Recorded
- Results From Objective Field Test Will Be Used To Fine Tune Algorithm
- Project Is Nearly Ready For A Full FOT

CICAS Signalized Left Turn Assist Program Elements and Status

- Laboratory Test Site Has Been Upgraded With SMS Radars And COTS Sensors For Increased Accuracy
- Work Continues On Algorithm Development
- Field Observations Of Traffic Turning Movements Continue At Test Intersection Using Laser Scanner And Radar
- Laboratory Test Site Is Now Being Prepared For Human Factors Testing
- Pilot FOT At The Laboratory Test Site Planned For Early Next Year.

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