Deploying Vehicle-Based Technologies
Considerations and Lessons Learned

Andy Alden
VA Tech Transportation Institute
aalden@vtti.vt.edu
Virginia Tech Transportation Institute (VTTI)

- Located near Virginia Tech in Blacksburg, Virginia
- Home to the Virginia Smart Road facility
- Virginia Tech’s largest research enterprise
- 300 staff members and students
- Nation’s 2nd largest Transportation Research Institute
- Approx. $30M Research funding (FY 2010)
VTTI Capabilities and Resources

• Expertise and experience
  – Driving data acquisition
  – Data storage, handling, analysis

• Facilities
  – Virginia Smart Road
  – The Instrumented City (Blacksburg)
  – Crash simulation – Injury Biomechanics
  – National Tire Research Center – Virginia International Raceway
  – Truck simulator
  – Vehicle fleet including trucks, buses, vans, pickups, SUVs, cars, motorcycle(s)
Data collection system box
under passenger’s seat

Front VORAD

Rearward Camera

Face & Forward Cameras
Camera Vision Systems

- **Focus Areas**
  - Lane change behavior
  - Driver spatial awareness
  - Benefit of IVS technology

- **Methods**
  - 12 commercial drivers
  - 1 fleet - 1 terminal
  - 6 instrumented trucks
    - Forward- and side-mounted radar
    - 8 camera views
Drowsy Driver Warning System

Research Objective

Collect data that can be used to evaluate the effectiveness and operational capabilities, limitations, and characteristics of a drowsiness monitor.
AVLS Installation

• Component mounting
  – User interface
  – Main Unit
  – Ancillary
    • Antennas

• Connections - routing
  – Power
  – User interface / display
  – Antennas
  – Vehicle network
  – On-board systems
Equipment Installation Considerations

• Connections!, connections!, connections!
• Equipment sharing
  – Leave wiring, antennas, etc.
  – Share more expensive components
• Interference from other equipment
  – Radios
• Beware the parasitic loads
• Antenna placement
Communication Considerations - Data

• Type
  - GPRS
  - SMS
  - 4G LTE
  - Satellite
  - Bluetooth

• Adequate bandwidth

• Data transfer costs

• Automatic signal reacquisition
Communication Considerations - GPS

- Reliability
  - Blocking (trees, buildings, topography)
  - Last known good location
  - Interference (LightSquared)

- Augmentation
  - WAAS
  - DOT efforts
  - Obstacle warning?

- Accuracy notification
Integration with Other On-Board Systems

- Connections
- Signal
- Data format
- Speed
- Resolution
- Matching or adequate data resolution
- “Plug and Play” standards (Clear Roads, e.g.)
- Vehicle network (CAN bus, J1939)
AVLS/Human Interaction – The Good

• Improved safety
  – Location, movement
  – Fatigue prevention

• Record keeping
  – Less paperwork
  – Improved reporting accuracy

• Investment and involvement

• Less concern of damage claims
AVLS/Human Interaction – The Bad

• Distraction – Eyes-Off-Road
• Poor software interface issues
• Perception of “Big Brother”
• Poor training and frustration with system
• Dependability and operator’s reliance upon it
AVLS/Human Interaction – Recommendations

• Involve the operators up front
• Provide exceptional training
  – Operators
  – Supervisors
• Consider how and when the system will be used
• Good software interface
  – Touchscreen
  – Voice recognition
• Interface mounting and speed lockout
• Consider Eyes-Off-Road
Future Considerations - Connected Vehicle

“A multimodal initiative that aims to enable safe, interoperable networked wireless communications among vehicles, the infrastructure, and passengers’* personal communications devices.”

* And others

Reference: www.intellidriveusa.org
Connected Vehicle Applications

• Safety
  – Collision warning
  – Traffic signal violation warning
  – Emergency notification

• Mobility
  – Adaptive traffic signals
  – Intermodal transfers
  – Event and emergency planning/response
  – Parking location assistance

• Environmental
  – Eco-routing
  – Multi-modal routing
  – Adaptive roadway lighting
  – Smart intersections
• Data sources
  – Vehicles as mobile probes
    • 2012 stability control required on passenger vehicles
    • Maintenance vehicles (speed, air temp, fuel usage)
  – Roadside sources (weather, pavement, signals)
    • NCAR weather algorithms

• Integration with MDSS

• Improvement of vehicle location technology
Future - Optimized Winter Maintenance

• Use of Connected Vehicle network and data allows more effective and efficient deployment of pre-treatment, treatment, and plowing operations

• Local weather information from Connected Vehicle network
  – From vehicles:
    • Temperature, barometric pressure, precipitation sensors, head lights
    • Activation of ABS, Stability control, traction control
  – From roadside equipment:
    • Pavement temperatures, humidity, etc.

• From on-board equipment in maintenance vehicles
  – Application rates
  – GPS, Time