Intro to DSRC

- Definition
- Standards effort
- FCC rules
- Deployment of DSRC systems and infrastructure
- Focus - Rural Applications
"... a short to medium range (1000 meters) communications service that supports both public safety and private operations in roadside-to-vehicle and vehicle-to-vehicle communication environments by providing very high data transfer rates where minimizing latency in the communication link and isolating relatively small communication zones is important."
Technical Characteristics

- 5.850 to 5.925 GHz
- Bandwidth = 75 MHz
- Shared, but Transportation is primary
- State DOT License Holder
- FCC Part 90
Current Applications

- Use 902-928 MHz
- Unlicensed
- Toll Collection
- Garage door openers
- CVO (commercial vehicle operations)
- Telephones
## Comparison

<table>
<thead>
<tr>
<th>Parameters</th>
<th>902–928 MHz</th>
<th>5850-5925 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrum</td>
<td>12 MHz</td>
<td>75 MHz</td>
</tr>
<tr>
<td>Data Rate</td>
<td>500 Kbps</td>
<td>6 – 27 Mbps</td>
</tr>
<tr>
<td>Protection</td>
<td>None</td>
<td>Primary</td>
</tr>
<tr>
<td>Interference</td>
<td>900 MHz Phone; Spread Spectrum Radio; Radar</td>
<td>Some Radar &amp; Satellite Uplinks</td>
</tr>
<tr>
<td>Max. Allow. Range</td>
<td>300 Ft.</td>
<td>3000 Ft. (1000 m)</td>
</tr>
<tr>
<td>Min. Separation</td>
<td>1500 Ft.</td>
<td>50 Ft.</td>
</tr>
<tr>
<td>Channel Capacity</td>
<td>1 to 2</td>
<td>7</td>
</tr>
<tr>
<td>Power (Downlink)</td>
<td>&lt;10 watts</td>
<td>&lt;2 watts</td>
</tr>
<tr>
<td>Power (Uplink)</td>
<td>&lt;4 mW</td>
<td>&lt;2 watts</td>
</tr>
</tbody>
</table>
Standards
Standards - World Wide

- **ISO** - TC204. WG15 - OSI Layer 7, WG16 - air interface.
- **CEN** - Layer 1, Layer 2, Layer 7.
- **Japan** - Developed DSRC standards published as ARIB T55.
- Complication - Japanese have a standard based on infrared technology – used in major cities and controlled by the National Police Agency.
- **Korea** - Brazil
Standards - North American

• The overall goal of the DSRC standard program is to develop a set of DSRC standards that will support full interoperability throughout North America while satisfying all of the application requirements. The emphasis is on public safety applications, but many others are considered and allowed.

• 802.11a
Standards - North American

- ASTM
- IEEE
- ISO
- SAE
- AASHTO
- ITS America
Stakeholders

- 3-M
- AASHTO
- ACUNIA
- AMTECH
- ARINC
- ARMSTRONG CONSULTING
- AHEROS
- CALTRANS
- DIAMLER-CHRYSLER
- DENS0
- GM
- GTRI
- HIGHWAY ELECTRONICS
- HITACHI
- IDMICRO
- IMEC

- INTERSIL
- ITS-A
- JHU/APL
- KING COUNTY METRO
- MARK IV
- MICOM
- MICHIGAN DOT
- MITRETEK
- MOTOROLA
- NISSAN
- NY THRUWAY AUTHORITY
- OKI ELECTRIC
- PATH NY/NJ
- RAYTHEON
Stakeholders

• SIRIT
• SUMITOMO ELECTRIC
• TECHNOCOM
• TOSHIBA
• TRANSSCORE
• VISTEON
• WASHINGTON DOT
• WI-LAN
FCC

• “Intelligent Transportation Services”
• Part 90 – PLMRS
• Frequency Coordination
5.8 DSRC Applications

- Over 1000 Applications Suggested
- List is still growing
- Large User Group Interest
Who?

- Automobile manufacturers
- Public Safety
- Parking Lot
- Retail Establishments
- Gas Stations
- Mass Transit
- Railroads
- etc.
What?

• Vehicle-to-vehicle Comm
• Traffic Flow (Speed & Volume)
• Lane Occupancy
• Priority Signal Preemption
• Toll Collection
• Freight Tracking
• Roadway Conditions
Vehicle Safety Communications Consortium

- Facilitate the advancement of vehicle safety through communication technologies.
- Identify and evaluate the safety benefits of vehicle safety applications enabled or enhanced by communications.
- Assess associated communication requirements including vehicle-vehicle and vehicle-infrastructure communications.
- Contribute to 5.9GHz DSRC standards and ensure they effectively support safety.
Application Examples
Assisted Collision Avoidance
Roadway Conditions
DSRC Deployment

• Rural
  - Lots of space
  - Utilities Sparse
  - Roads Less Traveled

• Urban
  - Little space
  - Utilities Plentiful
  - Congested Roads
**DSRC Infrastructure**

- On-board Vehicular Radio System
- Roadway Backbone Communications System
- Connectivity
  - Internet
  - Database Networks (SAN)
  - TMC
DSRC System

- Cell Tower
- Satellite
- Satellite dish
- Carrier Network
- Internet
- Data
- Data
- Data
DSRC Vehicular Radio
DSRC Roadside Antenna Array

Wide Area Array
DSRC Roadside Antenna Array

Directional Array
DSRC Flows

- Vehicle-to-Vehicle
- Vehicle-to-Roadside
- Roadside-to-World
Rural Deployment
Rural Deployment

- Obstacles
  - Lack of Power
  - Lack of Telecommunications Facilities
  - High Cost DSRC Deployment
  - Infrastructure: $$$$$$/Vehicle

- Total Cost Infrastructure ÷ Vehicle Population = $ per Vehicle
Deployment of a large scale system in a rural setting will cost about 60% of an urban system. However, cost per potential user vehicles is substantially higher for rural applications.
DSRC Rural

- How can cost of deployment be reduced?
Ad Hoc Communication Networks
Ad Hoc Communication Networks

• Randomly occurring communications networks that activate when two – or more – entities need to pass information between themselves.

• The network exists as long as the need for communication exists.

• The networks is usually supported by underlying infrastructure.
Ad Hoc Communication Networks

- **Examples**
  - Newspaper
  - Letter
  - Conference Call
  - World Wide Web
  - This Discussion Group
AD Hoc Data Network
AD Hoc Vehicle Network

- Network established between vehicles and signal device
Rural Telematics Application

- Road Hazards
  - Ice
  - Flood
  - Accident
- Need to get information to DOT
- Need to get information to other vehicles
Urban-Rural

- 25 Vehicles per lane mile
- One network node per 1000 feet
- Available Carrier Network
- Cellular Available

- Sparse Network Node Population
- Once every 5 miles
- 4 Vehicles per lane mile
- Carrier Network un-Available
- Lack of Cellular
Rural Hazard
Rural Telematics Hazard

- Any Information Is Better Than No Information
- Use of Ad Hoc for “Store & Forward”
Store & Forward
Store & Forward
Lesson

- All Information is Valuable
- “Think Outside the Box”
- Take Advantage of What is Available
DSRC Resources

- James Arnold – FHWA – james.a.arnold@fhwa.dot.gov
- Lee Armstrong – Armstrong Consulting – lra@tiac.net
- Broady Cash – AIRINC – bcash@airinc.com
- Shel Leader – ITS/Communications – shel@sleader.com
DSRC Resources – WWW

http://www.astm.org/cgi-bin/SoftCart.exe/COMMIT/COMMITTEE/E17.htm?L+mystore+nc
a5160+1004745838

ASTM E17.51

IEEE SCC32 http://grouper.ieee.org/groups/scc32/index.html

IEEE standards http://standards.ieee.org/

SAE Discussion Forums http://www.sae.org/jsp/forumsindex.jsp

ITS America http://www.itsa.org/standards

http://www.its.dot.gov/


DOT ITS


Transit Standards Consortium http://www.tsconsortium.org/

IPV6 Forum http://www.ipv6forum.com/