

***5.9GHz  
Dedicated Short-Range  
Communication (DSRC)***

***History, Status &  
Likely Future***

***Dan Papiernik, TransCore  
Meeting of  
JCOTS/Traffic Safety and Technology Advisory Committee  
October 26, 2006***

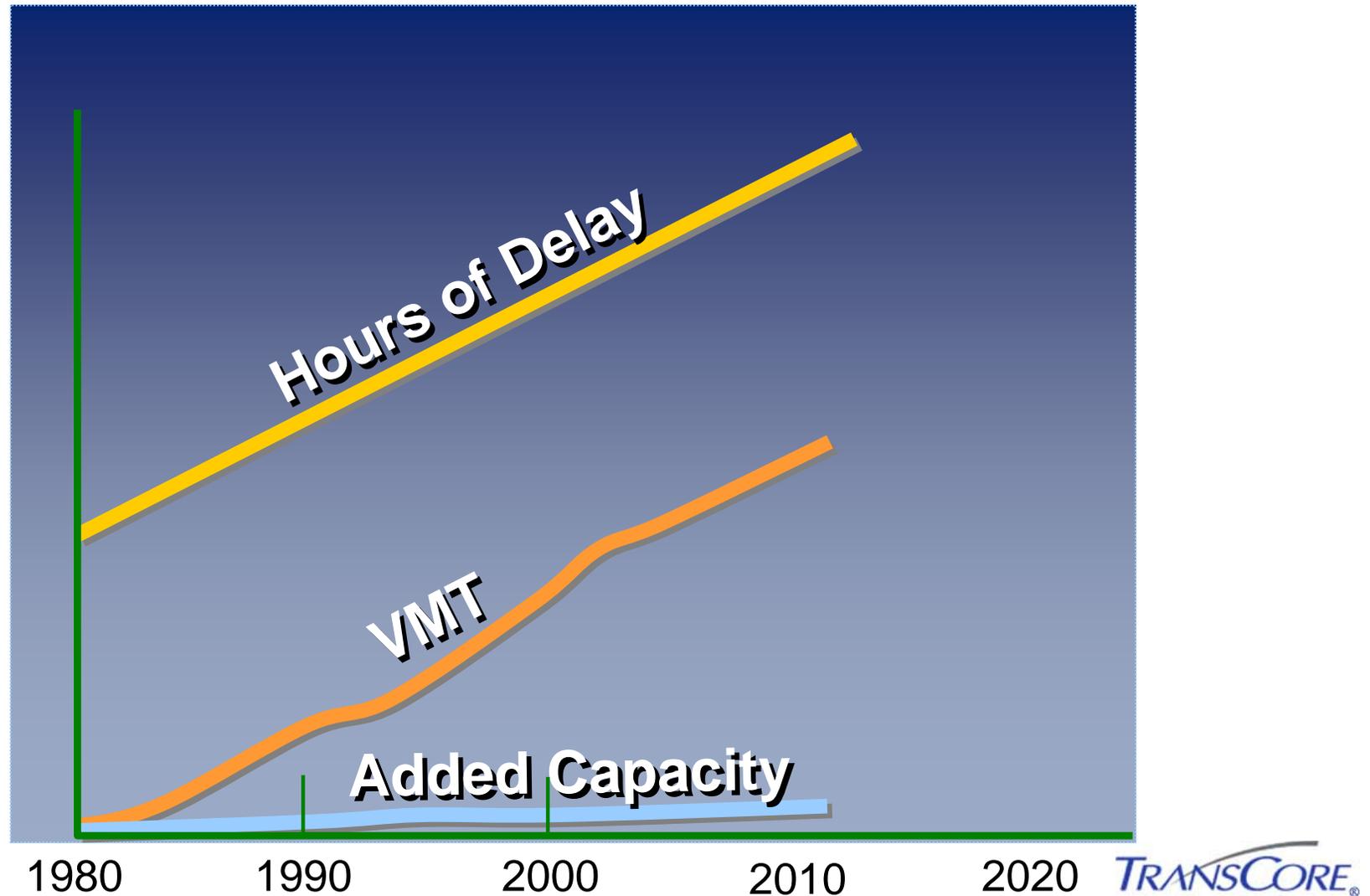
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# Today's Program

- DSRC 5.9GHz – What is it? How did we get here?
- Status of the 5.9 GHz development program
- Where do things go from here?

## The Future Holds.....

- A lot more cars – a little more roadway



# What's the Answer?

More cars thru the lanes?



Well...Maybe Not.

Instead....

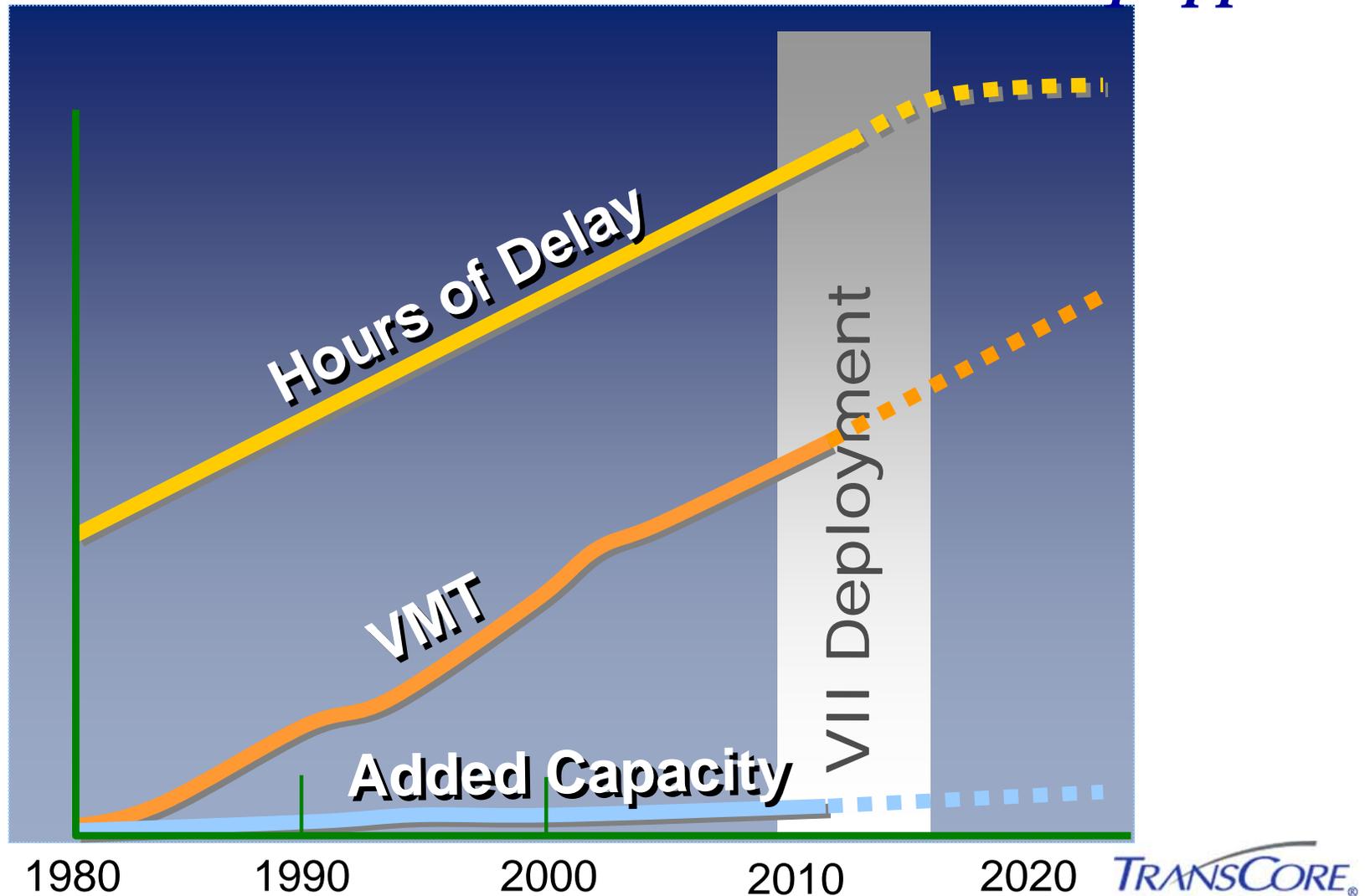
Smarter Systems -

*(Based on DSRC)*

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# The Future Holds.....

- A lot more cars – a little more roadway  
*...but better equipped!!*





# DSRC – What, How, When

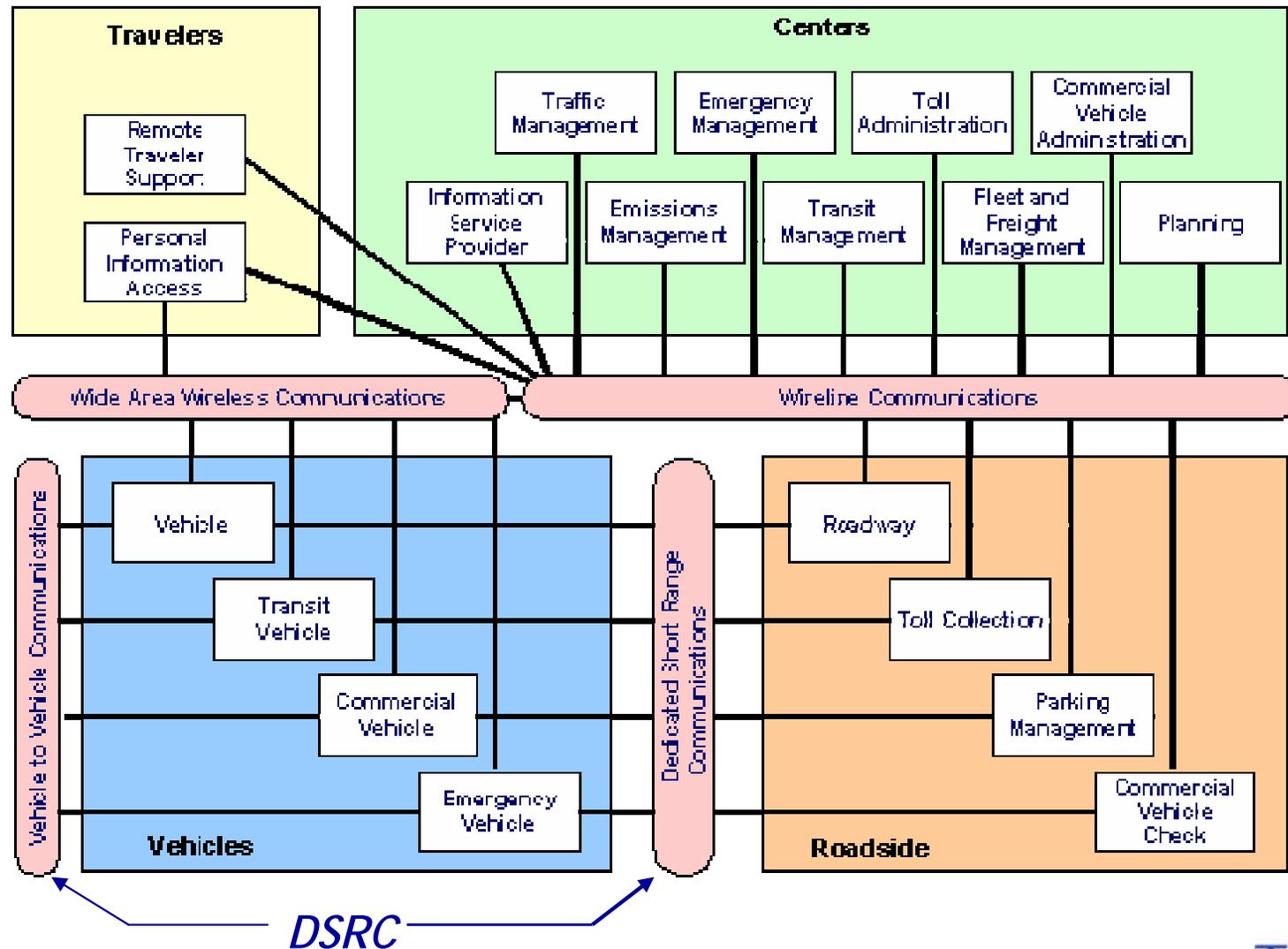
## 5.9 GHz DSRC – What Is It ?

### The Next Generation of Dedicated Short-Range Communications

- Transmission Range increases 2 orders of magnitude  
From ~10 meters today to ~1000 meters
- Transmission Rate increases 2 orders of magnitude  
From ~0.25 Mbps today to ~25 Mbps
- Tailored to the hi-speed mobile environment
- Near-instant access
- Highly secure & allows user anonymity

# DSRC – A Key Player from the Beginning

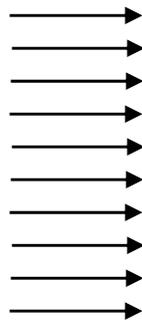
Two of the four main communication links in the ITS National Architecture.



# But....To Make It Work....

We needed a bigger pipe to support all the things planned for ITS

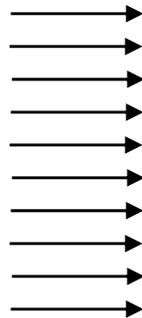
*All the applications won't fit in the contiguous 12 MHz allocated for DSRC in the 902 to 928 MHz band.*



**12 MHz in 902 to 928 MHz**

**Channels**

**Spectrum**



**75 MHz in 5.850 to 5.925 GHz**

*The 75 MHz spectrum between 5.850 to 5.925 GHz is what we refer to as "5.9GHz" and this new spectrum is now in place.*

## We Also Needed....

- Dedicated (Protected) radio spectrum so we don't try to push emergency messages to/from vehicles within heavily-used, public airspace
- And a system that:
  - works well in the high-speed vehicle environment
  - provides near-instantaneous service
  - permits anonymous operations
  - protects private data at a high level

*DSRC was developed to do all these things!*



*“5.9 GHz will emerge as a standard media for high speed wireless connectivity to substantially all vehicles within 10 years”*

**DaimlerChrysler  
-late 2004**



# DSRC – Status of Developments

# The Team

**CAMP**  
*Vehicle Safety Communications Consortium*

**DAIMLERCHRYSLER**  
DaimlerChrysler Research and Technology North America, Inc.



**GM**



**TOYOTA**  
TOYOTA TECHNICAL CENTER USA, INC.



**HONDA**



*IVI Light Vehicle Enabling Research Program*

**ITS AMERICA**

**IBTTA**

ITS 5.9 GHz  
 Radio Services

**ARINC**  
YOU WON'T BELIEVE  
 WHAT WE CAN DO.

5.9 GHz  
PHYRATIC DEVELOPMENT PROGRAM

**OmniAir**

**TRANSCORE**

**TechnoCom**  
Wireless Location Leaders

**Raytheon**

**CONEXANT**

**INDUSTRY CONSORTIUM  
 DSRC**

**DIC**

**ATHEROS**  
COMMUNICATIONS

**sirit**  
Technologies

**Highway**  
Electronics

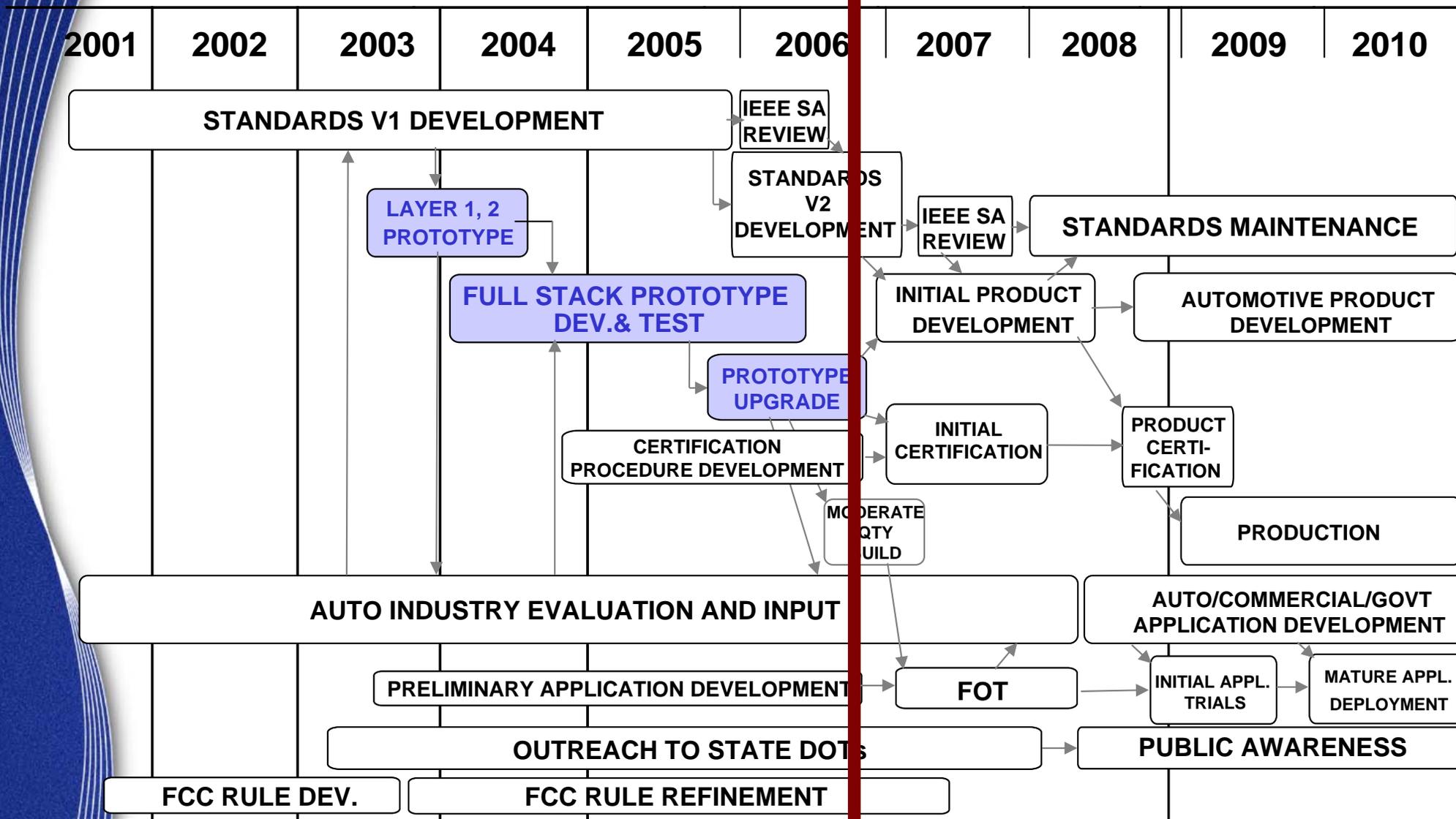
**MARKIV**

**Standards  
 Bodies**

- IEEE
- SAE
- ASTM
- ISO

- DOT**
- NHTSA
- FHWA
- Industry  
Canada
- FCC

# DSRC Program “Published” Timeline



The process for the DSRC component alone has been eleven years (going back to 1995). **Today**

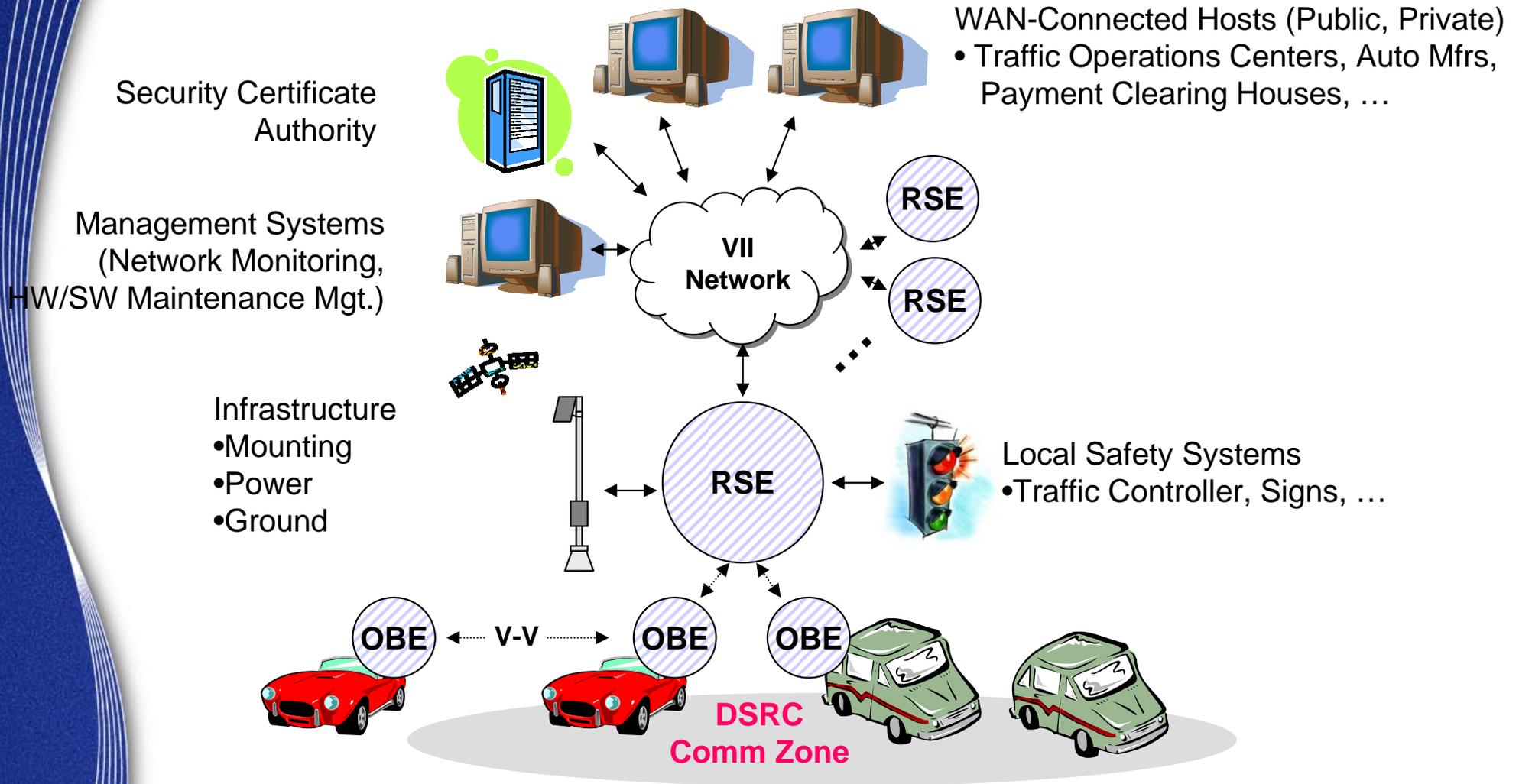
← Spectrum allocation work began in 1995

## DSRC Prototypes are Real....



- **First Generation RSUs and OBUs are available**
- **Testing now underway**

# Vehicle-Infrastructure Integration (VII)



**OBE** = DSRC Onboard Unit

**RSE** = DSRC Roadside Unit

*represents DSRC role*

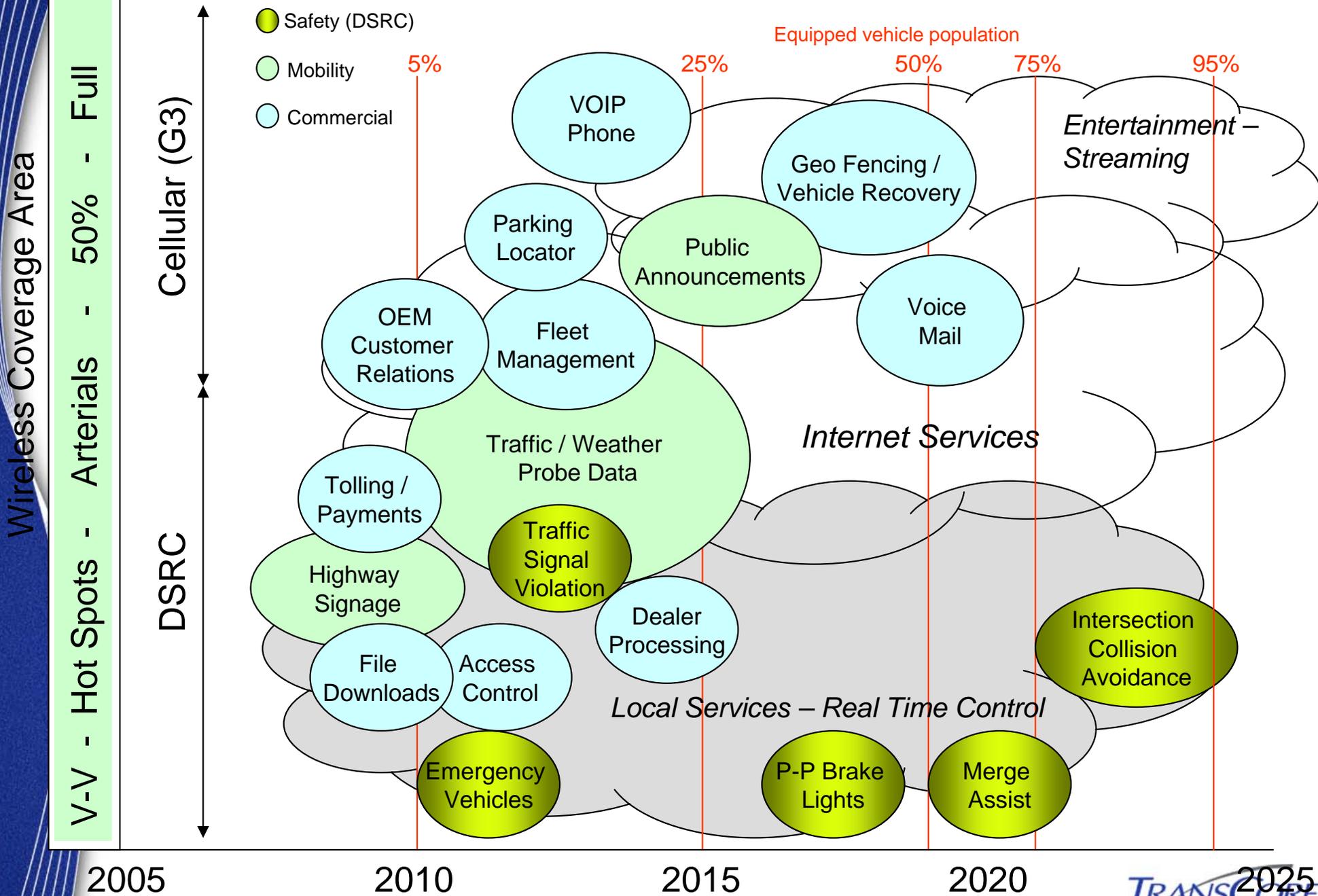
# What Does Rest of World Think ?

- Watching U.S. activities with GREAT interest
  - Some countries are envious of advanced U.S. position with respect to DSRC and VII initiatives
  - They are therefore proponents of open-standards
- Categorically believe U.S. is on right path
- Plan to implement same technologies in their own timeframes
  - Some regions already petitioning for spectral allocations

## 5.9 GHz DSRC Application Types

- Upwards of 140 applications defined to date
- Vehicle Safety: 60 - 70 applications
  - Researched by automotive industry
- Public Safety: 10 - 15 applications
  - For first responders, e.g., police, fire & rescue, but also includes items as tolling and traffic management
- Other – approximately 60 applications
  - Numerous vehicle-centric payment systems
  - E-commerce
  - Fleet/CVO management
  - And everything else!

# Mapping VII Applications



## VII – Day One Applications

- Traffic Signal Violation Warning
- Stop Sign Violation Warning
- In-vehicle Signage (road advisory)
- In-vehicle Signage (local notification)
- Roadway Conditions (weather and potholes)
- Traffic Management & Control
- Alternate Route Guidance
- Traffic Information
- Electronic Payments (tolls, gasoline, parking)

*'Day One' means system is capable of supporting the application, NOT that the application will be activated*



# DSRC – Where From Here?

## Complicated Development Plan

- Development of VII and DSRC are solidly linked
  - VII is totally dependent on DSRC
  - DSRC's 'reason-for-living' is VII
- Lots of testing before a commitment to deploy
  - Proof of Concept: (Does it work?)
    - POC is Medium scale: 10's of RSU's, 100's of OBU's
  - Field Operational Test: (Does it break when loaded?)
    - FOT is Large scale: 100's of RSU's, 1000's of OBU's

*Still leaves some 'Hard Questions' to answer: protecting privacy, allowing anonymity, managing legal liabilities, data ownership, deployment approach and last but not least: paying for it all*

## Complicated (and Fragile) Schedule

	Announced	<i>Educated</i>
	<u>Plan</u>	<u>Guess*</u>
Start POC Testing	1Q06	<i>2Q 2007</i>
Start FOT Test	1Q07	<i>3Q 2008</i>
Hard questions answered	3Q08	<i>3Q 2010</i>
<b>Deployment decision</b>	3Q08	<i>4Q 2010</i>
Initial infrastructure	2010	<i>2012</i>
Initial vehicles	2011	<i>2013</i>

*\*Schnacke (2006)*

## Infrastructure Side

Assumption: Positive 3Q 2008 deployment decision  
(or Positive 4Q 2010 decision)

- First safety priority: Intersections (~200,000 sites) + Other (~50,000 sites)
- Current plan: Equip ~250,000 locations with DSRC beacons over 6 years
- Realistic start: 2010 (or 2012)

## Vehicle Side

Assumption: Positive 3Q 2008 deployment decision  
*(or Positive 4Q 2010 decision)*

- Normal OEM design/implement cycle: 3 years
  - First DSRC-equipped vehicles could appear in 2011 model year *(but more likely to be 2013 model year)*
- Normal model deployment cycle: Start in high-end vehicles & push down
  - Some indications the pushdown may occur more rapidly than usual

## Vehicle Buildup Scenario

- Using most optimistic assumptions, a possible scenario is (in millions):

<u>Year</u>	<u>Vehicles</u>	<u>Cumulative</u>
2011 <i>(2013*)</i>	1	1
2012 <i>(2014*)</i>	4	5
2013 <i>(2015*)</i>	8	13
2014 <i>(2016*)</i>	12	25
2015 <i>(2017*)</i>	16	41
2016 <i>(2018*)</i>	16	57

.....out of a U.S. vehicle population of ~220 million

*\*Schnacke - educated guesstimate*

# VII-equipped Vehicle Population Projection

% Vehicle Population

Source: VIIC:  
Ford, GM, Honda,  
Toyota, Nissan,  
DCX, VW, BMW

'VII-equipped' =  
DSRC + GPS

*New Cars Equipped from Factory*

*Total Cars on Roadway*

Antique and Collector vehicles not converted

*Where it gets 'interesting' for toll agencies to begin utilizing 5.9 GHz payment applications*

**Assumes:**  
**200m vehicles on road**  
**15 m built each year**

2005

2010

2015

2020

2025

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## Summary

- VII is an extremely important US DOT initiative
- VII development is heavily funded, but is very complex and likely to suffer some delays
- VII deployment (both infrastructure and vehicles) is not a certainty – schedule driven by \$\$\$
- DSRC is the beating heart of VII, but is also very important to many commercial applications
- DSRC is real and progressing rapidly
- US DOT has funded most work (lots of \$\$\$)

*Despite its maturity, DSRC 5.9 GHz deployment is tied to many factors. It is NOT 'just around the corner'*

***Thank You!***

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