



**PUBLIC-PRIVATE AGREEMENTS/ARRANGEMENTS  
ASSOCIATED WITH VII IMPLEMENTATION**

**August 15, 2005**

## PUBLIC-PRIVATE AGREEMENTS/ARRANGEMENTS ASSOCIATED WITH VII IMPLEMENTATION<sup>1</sup> -

### A. EXECUTIVE SUMMARY

#### 1. Definition of Vehicle Infrastructure Integration

*Enhanced real time communication among vehicles, and communication between vehicles and roadside “hot spots” linked to transportation agencies and commercial service providers, can provide a wide range of enhanced safety, mobility and convenience services. Examples include collision avoidance, road departure warning, traffic management information, vehicle maintenance notifications, and a variety of location-based consumer services. Some of these opportunities are already being exploited through proprietary systems.*

*Many of these services could utilize a standardized, high speed data communications network that would support transfer of information between vehicles, between vehicles and roadside traffic control devices, and through a backhaul network to remote providers of traffic management, vehicle maintenance and a host of driver-oriented convenience services. The establishment of this standardized transportation communications system is called Vehicle-Infrastructure Integration (VII).*

#### 2. The System and Services

*Key components of this system include:*

- On-board equipment installed by vehicle manufacturers at the factory includes linkages from the vehicle operating systems, geolocation technology, and driver interfaces using dedicated high speed communications for two-way communication with other vehicles and roadside equipment.*
- Roadside equipment located at strategic points on the freeway and arterial network – urban and rural – connected to local active safety devices and/or to the backhaul communications network.*
- The backhaul communications network providing connections from vehicles through the roadside equipment to providers of public traffic control and mobility services as well as to the vehicle manufacturers and other third party private service providers.*

*There is a large number of VII-based services of interest to the public sector (federal, state and local public transportation agencies) and to private sector (vehicle manufactures and related service providers). The use cases that underlie these services are still under discussion – together with presumptions related to charging. However, four general classes include:*

- Active safety applications including intersection collision avoidance, violation warning, turn conflict warning, run-off-road departure warning, vehicle-to-vehicle collision avoidance/mitigation, etc.*
- Vehicle diagnostics and maintenance including safety systems functionality indicators, warranty notification and other customer support matters, etc.*
- Mobility and road maintenance applications including provision of road weather conditions data, active construction zones, emergency vehicle preemption, probe-based*

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<sup>1</sup> By Stephen Lockwood, PB Consult, Washington, DC; [lockwoods@PBWorld.com](mailto:lockwoods@PBWorld.com); 301-816-1848

*traffic management, pavement conditions, electronic tolling, parking and public fleet management, etc.*

- *Driver/consumer convenience services including traveler information, anti-theft services, vehicle diagnostics, auto manufacturer-customer relations, and other location-related consumer services such as service outlet information, parking location information and electronic payment, etc.*

### **3. The Benefits**

*The functionalities supported by the data communicated by VII promises dramatic improvements in all the above service areas. The principal benefits accrue to public safety. As current accident mitigation techniques are approaching an area of diminishing returns, increased communication between vehicles and the roadside become an increasingly crucial and cost-effective means of saving lives and reducing injuries. The public will also benefit from improved mobility, as the current transportation infrastructure and its various control systems suffer from a dearth of the real-time data needed for efficient operations and maintenance. Other benefits could be realized in a range of services supporting vehicle manufacturer and other commercial interests.*

### **4. The Need for Public-Private Partnership**

*There is a range of possible system options to foster the development of vehicle-infrastructure integration (VII). They are characterized by varying roles for public and private sector entities – collectively and individually. Each provides a different level of assurance regarding the provision of the complete range of potential VII benefits. One set of options is based on limited public sector support confined to the local active safety function with minimum federal involvement in standards, data base, funding and oversight. Other services might be provided on ad hoc basis by separate private entities on a commercial basis.*

*An alternative option presumes a structured public-private partnership between of the motor vehicle manufacturers and the public sector as a nationally-coordinated effort including near-simultaneous rollout of new vehicles with standard on-board equipment together with public support of a backhaul communications network supporting a range of public mobility, vehicle and convenience services. Such a nationally-coordinated effort has the potential to realize the desired services faster on a nation-wide basis, so as to maximize both commercial and public benefits and to provide consistent governance – for both public and private benefit. Furthermore, there may be considerable potential in cost sharing in infrastructure provision. While it is not the only approach, this option can be used as a starting place to examine key issues related to business models and cooperative public-private arrangements and agreements – and is the major focus of this memo*

*However, achieving such a standardized and coordinated deployment presumes a structured set of arrangements among the principal parties who are critical to deployment, investment, and implementation -- and to operating the VII system. These “Primary Stakeholders” include:*

- *Motor vehicle manufacturers industry represented by an industry coalition*
- *Public sector transportation infrastructure owner/operators (state and local transportation agencies)*
- *Federal government as policy maker and funder of public transportation systems of national significance, and representing the interests of the road-using public*

*In addition to these Primary Stakeholders, others include private communications network service providers, equipment and systems suppliers to the Primary Stakeholders, and other providers of transportation-related convenience and content services that may support vehicle manufactures in their supply of services to their customers.*

## **5. Business Models and Supporting Agreements and Arrangements**

*VII as a concept is both a set of public services and a set of businesses involving multiple private sector players in several industries and several layers of government. Development of VII as a program involves each of the several stakeholders in multiple business or program relationships – formal and informal – related to the range of services. The specifics of these “business models” on the private sector side are a proprietary matter: On the public side, they involve key matters of government and agency policy and program as well as intergovernmental relations. However, as part of all business models and irrespective of the specific business strategies, the success of VII will also be dependent on the public-private arrangements and agreements between the vehicle manufactures collectively and with the public sector as providers of infrastructure and related services*

*The system-level presumptions of the option under discussion -- the need for nationwide deployment, technical uniformity, controlled time-certain rollout, secure systems, technology and system stability consistent with vehicle life cycles --suggest a business models that accommodates a “national” approach – or at least strong central coordination – following the precedent of the creation of the Interstate Highway. This is somewhat different from the current “model” of the federal-aid highway program that is based on formula-based grants, discretionary uptake by states requiring matching funds and conformance limited to general standards and approaches. The business model must also create the appropriate level of security and stability in the context of the private telecommunications and information services industry that characterized by aggressive competition among competing systems, dynamic technology, volatile business entities, evolutionary rollout of new systems and services, etc. A key factor in considering business models is the degree to these presumptions can be accommodated.*

## **6. Unprecedented Requirements**

*These agreements and arrangements must reflect the key requirements of VII as currently understood, including: time-certain coordinated rollout commitments; the need for standards and performance specifications suitable to the in-vehicle and landside communications infrastructure contexts; the nationwide, dispersed nature of the roadside communications links; the need for robust, secure communications; potential public-private cost-sharing; and minimal burdens on state and local government.*

*A set of general principals regarding institutional structure follows from the above features:*

- Priority functions and services recognizing the public sector’s commitment to safety and mobility and including other motor vehicle and third party convenience services.*
- Institutional arrangements supporting long-term stability and interoperability and accounting for various commercial, technical, and political risks.*
- Institutional arrangements that are clear and simple, covering major commitments and assurances to insure sustainability.*
- Mutual commitments regarding technology and systems standards and specifications and data availability.*
- Decision-making reflecting stakeholder consensus and based on an appropriate form of representation.*

- *Mechanisms for continuing operation and management via a stable, permanent oversight function.*

*Accommodating these features requires the development of a set of agreements and arrangement among the Primary Stakeholders.*

### **7. Three Major Business Arrangements**

*Under the VII approach, the Primary Stakeholders are assumed to relate through a set of public-private commitments made via a set of long-term, quasi-contractual arrangements. The three basic arrangements needed to execute this VII concept include:*

*VII Basic Agreement – A formal agreement would affirm the Primary Stakeholders’ commitment to the safety objectives and other objectives supported by the program. The form of agreement would be designed to provide sufficient surety to support the commensurate commitments by the USDOT and the OEMs to investment in, and rollout of, VII infrastructure and VII-equipped vehicles, respectively, on a defined time frame. It therefore must embody the maximum practical mutual institutional and legal assurances, combined with the requisite technical and deployment descriptions, and a general agreement on an acceptable structure for continuing joint governance of the program.*

*Based on the initial review of this paper, some of the key issues meriting more detailed review and development include:*

- *Roles and relationships and form of representation among individual participants among the Primary Stakeholders*
- *Priorities and sequence regarding use cases*
- *Scope of system/services within and outside VII*
- *Basic systems and technology specifications*
- *Specific implementation steps, staging and schedule*
- *Expected life of in-vehicle and infrastructure technology*
- *Initial and subsequent geographic deployment coverage, location and availability criteria*
- *Approach to cost sharing, pricing and billing among the Primary Stakeholders*
- *Concept for contractual approach to deployment*
- *Concept for oversight regarding governance as well as network service operations parameters*
- *Approach to enforceability of agreements and remedies*
- *Disposition legal issues – privacy, security, liability, antitrust*
- *Critical go/no-go issues*

*Carrying out some of the required responsibilities on the public side may require certain Federal and state actions to support the necessary government commitments such as legislative mandates, regulations, licensing, performance standards, tax policy, direct or pass-through funding of continuing program.*

*Network Services Provision – The deployment and operations/maintenance of roadside equipment, required backhaul communications links, message switch/routers, control centers, etc. could be undertaken via conventional competitive procurement by the public sector, conducted by the Federal government. The procurement would draw on the existing network services industry experience in communications services provision (e.g., network assembly, pricing and billing, system/technology migration, etc). This contract for services would address initial systems configuration, systems additions, and the continuing provision of network and*

related services). It might also include approaches to cost-sharing with third party service providers.

*VII Operations Oversight Mechanism – Basic continuity and quality of service, governance and enforcement mechanisms must be insured through the establishment of a permanent oversight function for continuing VII system operations and maintenance. It must represent Primary Stakeholders’ interests (motor vehicle manufacturers, federal, state and local government) and be capable of overseeing the continuing provision of network services, technology upgrades, and service additions. This function could be supplied with through the creation of a formal legal entity or via a combination of regulation, standards, program mandates, and incentives.*

*Operations Oversight may constitute the most complex institutional issues as they involve the need to create a continuing, sustainable capacity to operate, manage, maintain and evolve a complex service-providing system with significant reliability and security dimensions. Furthermore, the desired approach must accommodate a range of private business and public interest concerns including allocation of prices, costs and revenues, and potentially, the ability to receive revenues and public funds. In any case, it is clear that the span of authority of the oversight components must be acknowledged by the Primary Stakeholders and that the governance functions must be perceived as representative and independent and maximally free of outside interference.*

*There are few existing institutional precedents possessing all the necessary attributes – especially the ability for a combined public-private involvement. However, there are some aspects of these experiences that may offer some guidance in development of an appropriate institutional vehicle or mechanism. Example entities that might involve joint public-private participation include:*

- *Federal Government Corporation (FGC)*
- *Public Utility*
- *Federal Agency*
- *Private Non-Profit Corporation*

*It is not now clear whether a single corporate-like entity is feasible or appropriate, or whether a set of mechanisms may be necessary to conduct several operational, regulatory, business and policy functions. To develop the appropriate oversight framework, specific federal legislation could be considered, subject to policy and legal constraints.*

## **8. Next Steps**

*This paper provides an initial exploration of the issues and challenges associated with each of these arrangements. For efficiency sake, each of the three topics – Basic Agreement, Network Services Provision, and Operations Oversight – may be pursued as separate issues. Recognizing sequence issues, it makes sense to give first priority to the Basic Agreement, followed by the Operations Oversight mechanisms. Issues related to network services provision must be resolved through further technical study before actual deployment arrangements – especially cost sharing – can be usefully considered further.*

*Key actions to be taken as follow up to review of this paper include:*

- *Establish separate Task Forces to pursue further development of Basic Agreement and Operations Oversight (with staff support) as soon as possible.*
- *Develop draft work programs – based on this paper and other inputs – as an initial agenda for the Task Forces.*

- *To further refine the next stage of work regarding operations oversight, a workshop should be convened assembling selected legal and policy experts with perspectives presumed to be helpful in development of government-industry program cooperation. Suggestions for participation have been solicited from the Business Model Task Force*

## **B. BASIC ASSUMPTIONS**

### **1. Vehicle-Infrastructure Integration as a Public-Private Partnership**

The realization of Vehicle-Infrastructure Integration (VII) has the potential to realize a wide range of transportation safety, mobility and convenience services quickly on a nation-wide basis. There is a range of possible system options to foster VII development. They are characterized by varying roles for the public sector (federal, state and local government) and private sector entities (the motor vehicle manufacturers and related service providers) – collectively and individually. Each provides a different level of assurance regarding the provision of the complete range of potential VII benefits. One set of options is based on limited public sector support confined to the local active safety function with minimum federal involvement in standards, data base, funding and oversight. Other services might be provided on ad hoc basis by separate private entities on a commercial basis.

An alternative option presumes a structured public-private partnership between of the motor vehicle manufacturers and the public sector as a nationally-coordinated effort including near-simultaneous rollout of new vehicles with standard on-board equipment together with public support of a backhaul communications network supporting a range of public mobility, vehicle and convenience services. Such a nationally-coordinated effort has the potential to realize the desired services faster on a nation-wide basis, so as to maximize both commercial and public benefits and to provide consistent governance – for both public and private benefit. Furthermore, there may be considerable potential in cost sharing in infrastructure provision. While it is not the only approach, this option can be used as a starting place to examine key issues related to business models and cooperative public-private arrangements and agreements – and is the major focus of this memo

The system-level presumptions of the option under discussion -- the need for nationwide deployment, technical uniformity, controlled time-certain rollout, secure systems, technology and system stability consistent with vehicle life cycles --suggest a business models that accommodates a “national” approach – or at least strong central coordination – following the precedent of the creation of the Interstate Highway. This is somewhat different from the current “model” of the federal-aid highway program that is based on formula-based grants, discretionary uptake by states requiring matching funds and conformance limited to general standards and approaches. The business model must also create the appropriate level of security and stability in the context of the private telecommunications and information services industry that characterized by aggressive competition among competing systems, dynamic technology, volatile business entities, evolutionary rollout of new systems and services, etc. A key factor in considering business models is the degree to these presumptions can be accommodated.

Recognizing both the lack of precedent and the broad program scope, a set of key issues have been set forth which are central to success of the proposed option.. These issues are organized around three key challenges: the basic agreements essential to support the initial commitment of principal stakeholders, public and private; the approach to coordinated system deployment, both contractual and support actions; and the cooperative oversight mechanism for continuing service provision. The paper recognizes that both the private industry business models and the viability of a public sector VII program (both federal and state) are dependent on the public-private arrangements and agreements between the OEMs collectively and the public sector. This paper provides an initial exploration of key issues.

## 2. The Primary Stakeholders

The Primary Stakeholders in these new relationships include private sector entities:

- Motor vehicle manufacturers industry represented in the VII program by a coalition of original equipment manufacturers (OEMs) each of which may have several component supplier/partners in the production of its new products and services).
- Public sector transportation infrastructure owner/operators (state and local transportation agencies).
- Federal government – in cooperation with state and local government – as policy maker and funder of public transportation systems of national significance, and representing the interests of the road-using public.

In addition to these Primary Stakeholders who are responsible for VII system performance, other stakeholders include private communications network service providers, equipment and systems suppliers to the Primary Stakeholders, and other providers of transportation-related convenience and content services that may support OEMs in their supply of services to their customers.

## 3. Definition of VII

Enhanced real time communication among vehicles, and communication between vehicles and roadside “hot spots” linked to transportation agencies and commercial service providers, can provide a wide range of enhanced safety, mobility and convenience services. Examples include collision avoidance, road departure warning, traffic management information, vehicle maintenance notifications, and a variety of location-based consumer services. Some of these opportunities are already being exploited – for certain vehicle classes in some regions – through proprietary systems.

Many of these services could utilize a standardized, non-proprietary electronic data communications network that would support transfer of information between vehicles, between vehicles and roadside traffic control devices, and – via a backhaul communications network – to providers of traffic management, vehicle maintenance and a host of driver-oriented convenience services. The dedicated short-range communications (DSRC) wireless frequency needed to accommodate these functions has already been reserved by the Federal Communications Commission (FCC) for transportation safety use, with an allowance for other use on a lower priority basis. This integration of vehicles and infrastructure through real-time communications technology is expected to provide immediate and widespread value to road users and road authorities.

These benefits will grow substantially as more and more vehicles are equipped with the necessary communications technology, and as the road-side infrastructure grows to cover more of the national transportation network. The establishment of this standardized transportation communications system – both on-board systems and road-side communications network – is called Vehicle-Infrastructure Integration (VII).

The implementation approach under discussion in this memo presumes near-simultaneous rollout of new vehicles equipped with on-board DSRC units and dedicated high speed data communications to roadside units tied into a nationwide communications network. Realizing the potential of VII entails an organized, national implementation beginning with widespread public infrastructure deployment, followed by implementation of related on-board technology in the new-vehicle fleet. The required degree of government-industry technical collaboration, the need

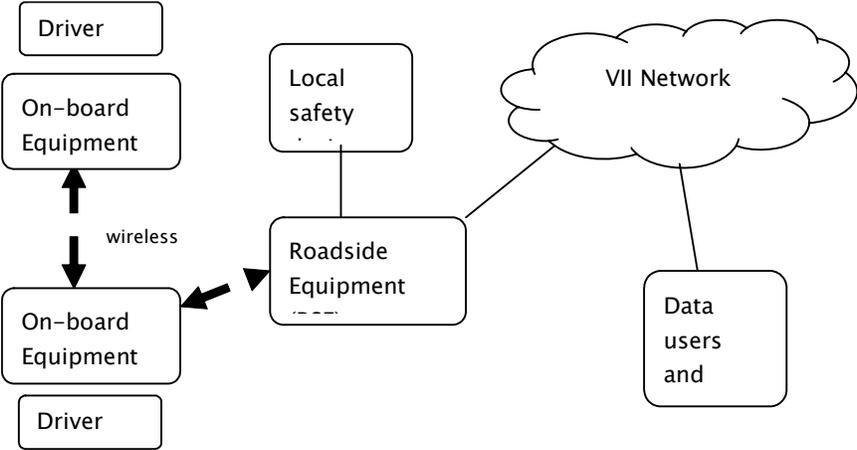
for coordinated national rollout and the high degree of reliability and security required is unprecedented. While it is not possible to predict the most likely implementation scenario, the standard Federal-aid transportation program model does not appear to be suitable for the compact, standardized and coordinated VII deployment and operations required, given the varying priorities, resources and capacities across jurisdictions.

The deployment option under discussion in this paper presumes a structured public-private partnership among the “Primary Stakeholders”: a coalition of the motor vehicle manufacturers and public sector transportation agencies led by the Federal government with strong state and local government support. Such a nationally-coordinated effort has the potential to realize the desired services faster on a nation-wide basis, so as to maximize both commercial and public benefits and provide consistent governance, for both public and private benefit.

While this deployment option is not the only possible approach, it can be used as a starting point to examine key issues related to business models and cooperative public-private arrangements and agreements that are the primary focus of this memo.

**4. The System**

The conceptual system to be provided by the Primary Stakeholders involves three basic components as shown in Figure 1 below.



**Figure 1: Conceptual VII System**

Key components of this system include:

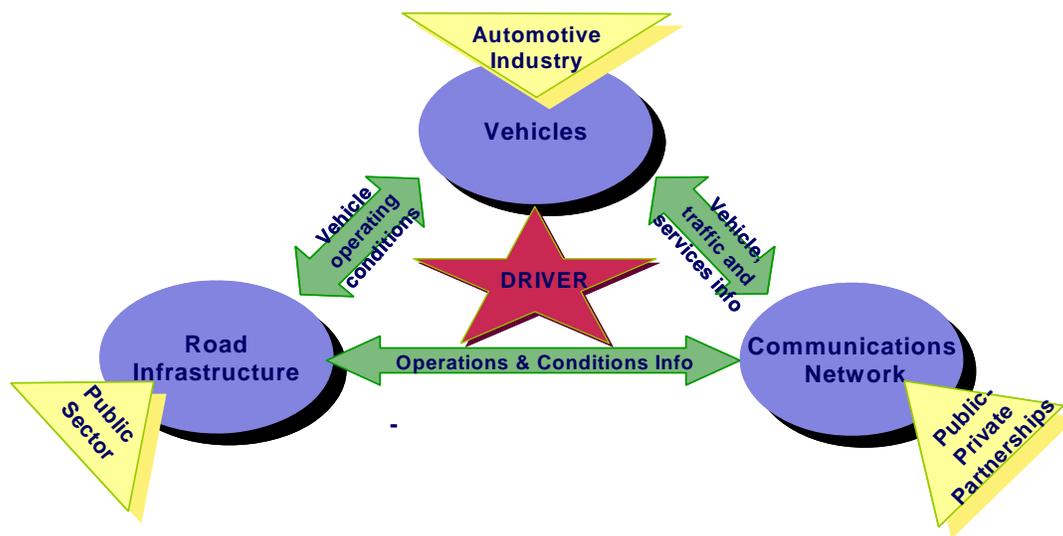
- On-board equipment (OBE) installed by vehicle manufactures at the factory includes linkages from the vehicle operating systems, geolocation technology, and driver interfaces using DSRC , enabling two-way communication with vehicles and roadside equipment.
- DSRC provides secure, low latency, high capacity wireless communications among vehicles and between vehicles and the roadside equipment (RSE) essential to the active safety functions. The RSE units are located at strategic points on the freeway and arterial network, both urban and rural. This equipment can be connected to local active safety devices and/or to the backhaul communications network.
- The backhaul communications network provides connections from the RSE to providers of public traffic control and mobility services as well as to the vehicle manufacturers and other third party private service providers.

Details of this architecture as currently contemplated are presented in FHWA's VII Architecture and Functional Requirements Version 1.1, July 2005. In addition there are several important related work efforts being undertaken by various intelligent vehicle, DSRC, safety communications, standards and mapping coalitions and projects, many undertaken with USDOT support, in cooperation with industry.

## **5. The Services and Benefits**

Up until the present, highway transportation service has been limited by the substantially separate and independent operation of vehicles and road infrastructure with limited data and communications among them and their owner-operators. As shown in Figure 2, implementation of VII introduces a fundamentally new set of relationships among the key components of highway transportation: the vehicles, the driver/owner, the vehicle manufacture, the road infrastructure, and public and private road-related service providers. The connections implied in the various data and communications links of VII establish the basis for a range of new functions and services that can fundamentally alter highway transportation and provide a new level of benefits to road users.

Principal benefits accrue to public safety. As current accident mitigation techniques are approaching an area of diminishing returns, increased communication between vehicles and between vehicles and the roadside become an increasingly crucial and cost-effective means of saving lives and reducing injuries. The safety benefit that could accrue from enabling real-time data communication of vehicular sensor data between individual vehicles and between vehicles and the infrastructure is potentially very large, since almost half of the 42,636 highway fatalities result from road departure or intersection collisions. The economic value of motor vehicle crashes on America's roadways has reached \$230.6 billion per year, or an average of \$820 per year for every person living in the United States.



**Figure 2: New service relationships**

Additionally, the current transportation infrastructure and its various control systems suffer from a dearth of the real-time data needed for efficient operations and maintenance. The delay caused by crashes, breakdowns, weather and construction work zones is now half of total delay. The ability for the infrastructure to read data from the vehicle sensors will greatly enhance transportation systems management and operations, including system maintenance functions that could benefit from more accurate weather and pavement condition data. Improved highway systems operations could make a significant impact on the \$67 billion economic cost of total delay.

Additional benefits could be realized in a range of services supporting vehicle manufacturer and other commercial party interests. The size of this potential captive market is indicated by drivers and passengers in the 14-15 million new light vehicles sold each year, in addition to the total vehicle fleet of 200 million.

Thus there are a large number of VII-based services of interest to both the public and private sector. The use cases that underlie these services are still under discussion – together with presumptions related to charging. However, four general classes include:

- Active safety applications facilitated by real-time communications among vehicles and between vehicle and roadside traffic control devices. Examples of these use cases include intersection collision avoidance, violation warning, turn conflict warning, run-off-road departure warning, vehicle-to-vehicle collision avoidance/mitigation, etc.
- Vehicle diagnostics and maintenance applications provide a means of communication between OEMs and vehicle owners. Examples of these use cases include safety systems functionality indicators, warranty notification and other customer support matters, etc.
- Mobility and road maintenance applications facilitated by the probe data and backhaul communications network, switches, and control centers. Examples of these use cases include provision of road weather conditions data, active construction zones, emergency vehicle preemption, probe-based traffic management, pavement conditions, electronic tolling, parking and public fleet management, etc.

- Driver/consumer convenience services facilitated by controlled access to data. Examples of these use cases include traveler information, anti-theft services, vehicle diagnostics, auto manufacturer-customer relations, and other location-related consumer services such as service outlet information, parking location information and electronic payment, etc.

The sequence of availability of these services will be important to public benefits, customer interest and business results. However it is dependent on ongoing technical developments, OEM-specific business arrangements, and OEM-public sector agreements yet to be reached. Some of these services will be part of standard new vehicle offerings while others will be options for a fee on a fee contractual basis or on an opt-in basis that may involve third party service and content providers

## **6. Business Models (See Appendix A)**

This memo does not deal directly with the principal market elements of the OEM business models for VII such as markets, services to be offered, producer/supplier relationships, cost, and profit structure. An analysis of these issues on the part of each OEM is the normal part of their strategic planning. Appendix A describes some of the basic “value propositions” focused on the service and qualities presumed to be part of the various business relationships between the Primary Stakeholders in VII, since many of these impact the fundamental arrangements and agreements between the OEMs, collectively, and the public sector as part of VII services delivery. These public-private arrangements and agreements are the focus of the remainder of this paper.

## C. PUBLIC-PRIVATE ARRANGEMENTS AND AGREEMENTS

VII as a concept is both a set of public services and a set of businesses involving multiple private sector players in several industries and several layers of government. Development of VII as a program involves each of the several stakeholders in multiple business or program relationships – both formal and informal – related to the range of services. The specifics of these “business models” on the private sector side are a proprietary matter. On the public side, they involve key matters of government and agency policy and program as well as intergovernmental relations. However, as part of all business models and irrespective of the specific business strategies, the success of VII will also be dependent on the public-private arrangements and agreements between the vehicle manufacturers collectively and with the public sector as providers of infrastructure and related services.

### 1. Unprecedented Requirements

As suggested by the value propositions and generic business model issues, the deployment of VII requires the development of a set of unprecedented cooperative agreements and arrangements, both legal and programmatic. The Primary Stakeholders need to define roles and relationships sufficient to support development and operation of a major nationwide system.

These agreements and arrangements must reflect the key requirements of VII as currently understood, including: time-certain coordinated rollout commitments; the need for standards and performance specifications suitable to the in-vehicle and landside communications infrastructure contexts; the nationwide, dispersed nature of the roadside communications links; the need for robust, secure communications; potential public-private cost-sharing; and minimal burdens on state and local government.

### 2. Key Assumptions

A set of general principals regarding institutional structure follows from the above features:

- The safety objectives provide the justification for the public sector’s involvement in the public-private partnership. While there are other public and private objectives as well, this priority is a key commitment of the Primary Stakeholders and the program is structured to support this principal objective.
- The policy and legal framework for VII must be reasonably well-defined and enjoy broad consensus support.
- Institutional arrangements must be clear, simple, and designed for maximum robustness in the face of corporate, market or political events and variations. Therefore agreements among the Primary Stakeholders must cover major commitments and assurances to insure sustainability. Basic value propositions and business model requirements of Primary Stakeholders must be assured. Therefore, agreements must incorporate mutual commitments regarding data and related responsibilities for basic use cases essential to all parties.
- For simplicity, it is presumed that the Federal government is acting on behalf of all levels of government in coordinating with their collective views as expressed through associations and other such mechanisms for their representation as it may evolve.
- On-going program decision-making must reflect Primary Stakeholder interests – public and private – based on stakeholder consensus. Therefore collective interests such as OEMs and states must develop an appropriate form of representation.

- To support the major investments in in-vehicle equipment and fleet turnover-related expected lifespan, long-term stability and interoperability must be built into the system and institutional arrangements. Therefore, agreements and arrangements must be structured to account for various commercial, technical, and political risks.
- The continuing responsibility for operation and management beyond deployment must be assured by a combination of commercial incentives in the infrastructure and services together with appropriate Primary Stakeholder oversight. To ensure this happens, a stable, permanent oversight function must be institutionalized.

Accommodating these features requires the development of a set of agreements and arrangement among the Primary Stakeholders.

## D. THREE MAJOR BUSINESS ARRANGEMENTS

Under this business model, the Primary Stakeholders are assumed to relate through a set of public-private commitments made via a set of long-term, quasi-contractual arrangements. An initial agreement would be essential to establish mutual commitments to deployment. Provision of network services and related support services – designed to meet the needs of the agreed-upon applications – could be accomplished through contractual arrangements with third-party private service providers funded by a dedicated Federal program, with varying options for private sector cost-sharing. The Primary Stakeholders might also establish a continuing joint oversight entity for the purposes of overseeing and managing deployment, and for continuing operation and maintenance of the RSE and related network services, including administering use and access rules.

In the above context, there are three arrangements that would need to be established.

### 1. The Needed Agreements/Arrangements

The three basic arrangements needed to execute this VII concept include:

1. VII Basic Agreement – The Basic Agreement would affirm the Primary Stakeholders' commitment to the safety objectives and other objectives supported by the program. The form of agreement would be designed to provide sufficient surety to support the commensurate commitments by the USDOT and the OEMs to the investment in, and rollout of, VII infrastructure and VII-equipped vehicles, respectively, on a defined time frame. It therefore must embody the maximum practical mutual institutional and legal assurances, combined with the requisite technical and deployment descriptions, and a general agreement on an acceptable structure for continuing joint governance of the program.
2. Network Services Provision and Contract – The deployment and operations/maintenance of RSE, required backhaul communications links, message switch/routers, control centers, etc. could be undertaken via conventional competitive procurement by the public sector, as conducted by the Federal government. The procurement would draw on the existing network services industry experience in communications services provision (e.g., network assembly, pricing and billing, system/technology migration, etc). This contract for services would address initial systems configuration, systems additions, and the continuing provision of network and related services). It might also include approaches to cost-sharing with third party service providers. These services must meet or exceed requirements defined in the Basic Services Agreement.
3. VII Operations Oversight Mechanism – Basic continuity and quality of service, governance, and enforcement mechanisms must be insured through the establishment of a permanent (in effect) oversight function for continuing VII system operations and maintenance. It must represent Primary Stakeholders' interests (motor vehicle manufacturers, federal, state and local government) and be capable of overseeing the continuing provision of network services, technology upgrades, and service additions. This function could be supplied with through the creation of a formal legal entity or via a combination of regulation, standards, program mandates, and incentives.

The sections below discuss key features of these three arrangements.

## E. THE VII BASIC AGREEMENT

Under any business model or institutional arrangement, VII program effectiveness will depend on Primary Stakeholders – OEMs/Federal government/state and local government representation – meeting technical, financial, geographic, and schedule commitments. A formal public agreement among the Primary Stakeholders would provide maximum surety in support of the significant public and private investments involved. However, the form of agreement would need to accommodate realistic features of the legal and institutional context of the Primary Stakeholders, including:

- The need for public and private commitment to the program’s principal safety objectives to gain public support.
- The need to establish a stable technological and operational environment consistent with the expected life of in-vehicle technology and public infrastructure investments.
- The potential at the Federal level for specific Congressional program authorization and appropriations in support of the Federal investment.
- The achievement of varying levels of specificity of commitment from all sides including approach to be followed if not all OEMs join the program, including allowances for entry and exit.
- The legal limitations on a Federal agency commitment and its implications for OEMs as cooperating partners, including enforceable remedies for non-performance (such as reimbursement).
- The importance of gaining state and local government support in light of the limitations on AASHTO and local government associations with regard to commitments on behalf of their members.

### 1. Level of Formality

The above characteristics suggest that the Basic Agreement among Primary Stakeholders would benefit from the highest degree of contract-like formality that might be possible within the framework of a Congressionally-authorized program and a set of independent private corporations. A contract-like approach to such a public-private partnership appears to be without precedent, but the limits regarding the form of agreement need further exploration. At a minimum, a joint policy declaration committing all parties in principle is essential. This could be reinforced through specific Federal program legislation and multi-year funding authorizations. On the private side, individual corporate commitments will be desirable as well as the joint commitment through an industry association to the VII system and rollout plans.

Depending on the degree of assurances that can be provided within the framework of a formal agreement, consideration could be given to a range of other standard Federal government actions to reinforce the policy and budget commitment needs described above. These might include:

- Policy declaration by the Federal government, and by state, and local government associations
- Legislative requirements for states to develop certain safety and mobility-related information and to provide certain services
- Federal regulations and tax policy requiring or supporting industry investments in crash-avoidance systems
- Long-term program funding from US DOT to fund state DOTs – and pass-throughs to local government – for the continuing upgrade of applications, to create markets for in-vehicle systems development and external services provision

- Licensing restrictions to identified uses for DSRC
- Opportunities for regulated and exclusive communications services provision
- Further development of performance standards relating to use of dedicated spectrum and access to OBE.
- Legislation regarding liability and for legal use of data collected
- Development of rules relating to access and use of dedicated spectrum and the various parts of the VII system (single and in total)

## 2. Commitment Specifications

From the OEM perspective, commitments from the Federal government regarding provision of network services are desirable to provide a firm basis for significant private investment. The issues that need to be addressed as part of that commitment need to be identified. An initial list (and starting point of updating) includes:

- Technical
  - ✓ Vehicle data elements to be enabled by the OEMs for anonymous transmission to the public sector
  - ✓ Aggregated data to be provided by public sector to OEMs
  - ✓ Network capacity available to OEMs for their use
  - ✓ Communications standards
  - ✓ Data/information content provided by both public (message switch/routers/control centers) and private (on-board vehicle) components of system to each other
  - ✓ Deployment pattern of network and non-network RSE including extension/upgrading approach
  - ✓ System availability standards at several area and network element levels
  - ✓ Sustainable commitment over lifetime of vehicles
- Business
  - ✓ Structure of the provision of program management services during both pre-deployment and operations
  - ✓ Services provided by public sector side
  - ✓ Form of representation of Primary Stakeholders during both pre-deployment and operations of the VII system
  - ✓ Management structure and services to oversee system operations for communications and message switch/routers
  - ✓ Indication of what information would be available to third party commercial entities and under what circumstances
  - ✓ Allocation priorities of any revenues derived from payment for use of any Network components or services
  - ✓ Approach to use of commercial third parties to use of network
  - ✓ Allocation of liability
- Institutional
  - ✓ Assurance of continuity/sustainability of Federal commitment
  - ✓ Form of representation of Primary Stakeholders during both pre-deployment and operations of the VII
  - ✓ Oversight institutional arrangements
  - ✓ Operations and maintenance responsibilities
  - ✓ Privacy and security principles, legal requirements and constraints
  - ✓ Arrangements for regular updates on progress in deployment

- ✓ Procedures to be followed in event of delay or other problems
- ✓ Recourse and termination procedures

The above items can be described on a standards and performance basis, avoiding the need to specify systems technology beyond what is necessary to assure vehicle-infrastructure communications interfacing. In addition to the systems description, distribution, and timing, the agreement might specify the general form of pre-deployment systems development program management, and the operations oversight entity procurement approach to provisions for sustainable network services.

## F. NETWORK SERVICES PROVISION

The network components – both RSE-related and network-related – would be made available within state and local jurisdictions nationwide. This system must be created through a combination of deploying of new elements and assembling available elements. The system must then be operated and maintained.

The initial deployment analysis suggests up to one hundred thousand or more RSE locations may be appropriate. The RSE, switches, routers, control centers, etc., will represent new infrastructure, as will certain components of the back haul communications. Notwithstanding the extent of this deployment, the effort is consistent with activities undertaken on a routine day-to-day basis throughout the US in the telecommunications and power sectors, using standard, well-known procedures and industry players.

In addition to hardware deployment, a collective effort will be necessary to develop the basic software needed by state and local governments to make use of the VII data and information. The assembled system would then be operated and maintained on a sustainable (effectively perpetual) basis, including real time operations, mapping, maintenance, security, billing, technology refreshment, etc.

### 1. Deployment Assumptions

Key features of the network services provision procurement relate to the geographic, temporal, and right-of-way framework. Such considerations include:

- RSE deployment and operations would ultimately be nationwide, in all 50 states and thousands of local government jurisdictions, substantially on public property. Initial deployment would be targeted to locations in response to a combination of factors including problem locations, support communications availability, deployment capacity, etc.
- The deployment would take place in a discrete and pre-specified time frame to coordinate with rollout of OBE by OEMs.
- The location of RSE would be pre-specified by the oversight entity – together with power, communications, and signal interface requirements.
- Standard components will be used.
- Any backhaul communications technologies (fiber, wireless, POTS) meeting specifications would remain as options, thus providing some flexibility in potential participants.
- The deployment approach will utilize the local deployment conventions of the utility industry regarding access, construction, oversight, etc.
- The overall approach to RSE deployment and network service provision must be designed for minimal burdens on state and local governments.
- Registration, security and maintenance considerations may also be included.

### 2. Local Deployment Support

The willingness of OEMs to invest requires clear assurances regarding the public sector ability to achieve the necessary deployment in local jurisdictions in a predictable time period. Deployment will involve the initial agreed-upon system of RSE and communications linkages. It is presumed that this will be undertaken by a private network services provider entity utilizing a consortium of contractors and local communications entities familiar with state and local

practice. As the system would be a public interest utility supported by Federal and state governments, it appears that the normal state and local government permitting process for utilities does not present any special burden and would not be subject to special exactions from state and local government beyond the usual permitted process. State and local signal owners will be involved in quality assurance roles regarding interface with signal controllers. Subsequent traffic control modifications would be carried out on a jurisdiction-by-jurisdiction basis, with technical standards developed cooperatively among Federal, state, and local government.

A willing partnership between the Federal government, the OEMs, and state and local transportation/public works entities implies that each local jurisdiction is sold on the value to its citizens of the systems, and recognizes that delay will disadvantage its citizens. A nationwide educational effort may be required. In addition, to streamline the deployment, consideration may be given to the need for an MOU or development of a national standard on the part of state and local associations, to support the permitting process regarding standards, requirements, and process.

### **3. Ownership vs. Contract for Services**

The necessary network services place a high premium on quality, security, reliability, and efficiency. In addition, the technology itself will evolve over time with communications technology, even while the network services must be maintained, consistent with contractually-specified performance criteria and the constraints of the service-life of the initial OBE technology. This suggests that provision of the functional network services and their maintenance, operations, and upgrading might be entirely through a contract-for-service approach, thus avoiding the limitations associated with direct public ownership of any infrastructure.

Irrespective of legal ownership, this model assumes provision of network services by (one or more) commercial network service provider entity/consortium that would deploy the systems components (RSE, switches/routes, control centers), assemble other communication network components, and provide the network services on a continuing basis. The contract for services would be executed between a deployment consortium – or possibly several regional consortia – and either the Federal government or the oversight entity (see below).

However, there may be liability issues associated with private ownership of RSE, and even direct private connections thereto. The question of ownership vs. purchase of service is therefore a complex issue, and it is not clear what, if any, components must be under nominal Federal ownership, as distinct from being provided as a service by a private entity. It may be that special legislation can resolve this problem. Therefore, while the provision of network services cannot follow the conventional Federal aid model of deploying or operating a publicly-owned infrastructure, the mix of ownership, lease, and contract-for-service requires further consideration.

### **4. Basic Network Service Scope**

The network service provision contract must provide for nationwide implementation and continuing network services, including:

- Large scale systems deployment and management
- Systems and technology acquisition and deployment, including interfaces with local and state government equipment as necessary

- Backhaul communications system assembly and deployment
- Liaison with local and state government regarding rights of way, and interfaces with local and state government equipment and systems
- Network management, including operations of message switch/routers and control centers
- Audit and billing administration
- Provision of adequate redundancy and security
- Technology refreshment
- Interfacing with certification functions
- Management reporting

This range of experience may be found within consortia assembled by existing telecommunications and power entities or within new specialized business entities established for the new range of services implied in VII.

## **5. Non-Technical Assumptions Impacting the Network Services Contract**

The network service contract would specify the system performance and availability features. As well as administrative rules for services provision, that will be established by consensus among the Primary Stakeholders and modified as necessary, during the life of the contract. In addition, it would contain certain other basic non-technical provisions that respond the nature of the services being provided:

- Adherence to performance, availability, and capacity demands on continuing real time basis, including low failure-rate tolerances for specific components.
- Perpetual (in effect) operation, management, and maintenance of the network services. Deployment will be in phases, with continuing additions (as well as modifications).
- Ability to refresh technology on the network services side (features, models, technologies) as improved capabilities and reduced costs enter the competitive environment.
- Pricing structure conventions to be employed regarding use of infrastructure.
- Capacity to develop commercial opportunities independent of VII where not inconsistent with the VII interests agreed upon by the Primary Stakeholders.
- Accommodation of turn-over in service provider, relating either to (1) commercial survival of private entities, or (2) rebidding for more favorable terms and contract features.

## **6. Cost of Service to Primary Stakeholders**

A key feature in development of the business models would be the basic assumptions about distribution of costs among the Primary Stakeholders.

- Installation Costs – It is presumed that the initial network capital costs (or the leasing cost equivalents capitalized) would be a one-time cost borne by the Federal government on behalf of the public sector, with possible cost-sharing potential on the part of the network service provider. Consideration must also be given to future expansion and modification of the system
- Operations & Management Costs – The continuing costs for the provision of national network services would include the items in E.4 above. Operations and management costs generated by the Primary Stakeholders (the Federal government, OEMs, State DOTs) would be allocated on an equitable non-profit basis on a basis as determined by the Oversight Entity. These costs to the Primary Stakeholders could be reduced by any revenues earned from private third party use of the network for agreed-upon applications.

- State/Local Applications Costs – The costs of certain basic applications commonly employed by state and local government may be part of the overall systems development process supported by the Primary Stakeholders. However, there will be costs associated with further applications custom tailoring that may be part of state and local agencies normal transportation program (including the use of applicable Federal aid).

Private Applications Costs – Beyond the basic applications agreed by the Primary Stakeholders, individual OEMs may choose to develop applications in various cost-sharing arrangements among customers, third party service providers, and the OEMs.

## 7. Cost-Sharing with Network Service Provider

Under this VII model, the general intent of the Primary Stakeholders in the network services provision contractual arrangement is to include maximizing cost-sharing opportunities with potential network service providers in order to reduce the costs to the Federal government. However, the range of allowable use of components of the network services infrastructure by the private service provider for cost-sharing remains a significant unknown. Cost-sharing opportunities may include one or all of the following: direct utilization of excess network capacity by the private service provider for non-VII purposes; development of business opportunities with individual OEMs using their communications channels; and/or efficient collocation of private equipment simultaneous with VII network elements to capitalize on reduced deployment costs.

Data flowing through the network may include the following categories:

1. Public data (traffic, weather)
2. OEM proprietary vehicle-related data (diagnostics)
3. OEM/content provider proprietary customer services data (service outlet locations, etc)
4. Driver/third party provided data (presumed to be following agreed-upon technology/interface standards) and that may or may not involve OEMs as part of a commercial transaction
5. Non-vehicle/non-transportation business, utilizing network components (such as fuel and fast food purchases)

Information under categories 2 and 3 is OEM-specific and may remain unknown for planning purposes. Category 3 remains uncertain in recognition of OEMs' inherent commercial and technical interests, but also the potential of needing to compete with other vehicle/network commercial competitors capitalizing on advances in wireless communications. Category 5 represents the use of the network capacity entirely outside the VII framework, and is apparently of interest to a range of information service providers. Thus, categories 3, 4 and 5 present cost-sharing opportunities that would reduce the cost of network provision.

Owing to the developing nature of potential OEM business models and their proprietary and non-uniform nature, there are no current uniform assumptions about how OEMs may wish to capitalize on the communications, RSE, and switch/routers elements of the network infrastructure. However, all VII network users will be required to conform to use and access rules negotiated initially between the Primary Stakeholders and administered by the operational entity. These rules may also be codified in law or regulation

Any cost-sharing approach may introduce issues regarding the level of control by the primary stakeholder over the business model imposed by the contract and will need to be carefully negotiated, if pursued. Primary Stakeholders and end users will need to consider any uncertainties introduced by a reduced ability to both predict and/or alone control their long term

costs of participation in VII unless there is a high degree of stability in the network in terms of services provided, technology used, and costs associated.

## **G. VII OPERATIONS OVERSIGHT**

Following the initial VII system deployment, systems operations will commence including the need to manage, maintain and expand the system in real time and on a sustainable basis. An entirely distinct set of issues must be faced regarding governance of an on-going system that need to be resolved prior to the commitment to deploy along with their institutional, constitutional, organizational and financial characteristics and dynamics. An arrangement must be selected or designed that meets the obvious requirements for technical integrity, institutional stability, financial sustainability, and sectoral cooperation and equity.

Continuing oversight will be desirable to represent collective Primary Stakeholders' interests in several areas, including:

- Overall policy, especially regarding use of the network
- Ensuring continuity of service and quality assurance as provided by the network service provider arrangement
- Considering issues related to service improvement
- Administering and enforcing use and access rules
- Adjudicating issues relating to differences among parties regarding services, allocation of responsibilities, liabilities and/or costs

There is a range of options that could serve these functions, ranging from a formal entity to a combination of regulations, agreements, and Federal agency program commitments.

### **1. Governance**

From a governance perspective any oversight entity must provide the appropriate equity participation of the Primary Stakeholders. This means several things, including:

- The Governance system must be perceived to be politically independent. This will pose an issue for the public sector stakeholders who are all members of governments with their discretion circumscribed unless specifically set forth in legislation.
- There must be satisfactory representation among key stakeholders in decision-making. Recognizing that there are issues of individual corporate and public jurisdictions involved, the relative "collective" balance among the private vs. public stakeholders must be determined.
- The span of control of the decision-making authority of the Oversight entity must be acknowledged by the Primary Stakeholders (i.e., individual OEMs, individual states).
- Information flow and decisions fully documented.
- The Oversight entity must be demonstrably responsive to its service orientation and public goals.

It is apparent that the governance issues mix questions of overall program policy that address both public and private issues, issues of a possibly regulatory nature, and issues that may differentially impact the financial interests of various parties.

### **2. Operations**

From the operational side, an executive arm, with the capacity to execute policy and provide day-to-day management of the private network service provider-contractors, representing Primary Stakeholders directly or indirectly, is desirable. The oversight needs to relate closely to network services provision, including:

- Processes for handling coordination of current and new applications

- Involvement in price setting, audit, and billing administration
- Assurance of maintenance of security and privacy
- Assurance of systems reliability
- Oversight of technology refreshment
- Oversight of certification authority and other functions relating to frequency management

Two key issues are already evident:

- Frequency Management – A key operational issue will be frequency management. FCC rules for the reserved public safety and private wireless DSRC service in the 5.9 GHz band establish a licensing process for the “RSE”. However, the FCC rules do not include any program for prior coordination, and instances of interference could require cumbersome and time-consuming conflict resolution that would be impractical, given the potential quantity of RSEs. The DSRC community has proposed designation of a third party “DSRC Frequency Screener/Database Manager” to” (1) implement and oversee a proactive spectrum management program to conduct the upfront interference analysis for proposed DSRC sites; (2) manage the RSE site registration database; and (3) determine the eligibility of proposed DSRC applications according to the priorities set by the FCC. In addition, such an entity could also manage the Public Key Infrastructure (PKI) Encryption system that secures access to the public safety-related DSRC transmissions.
- Access to the VII Network by third parties – The range of markets presented by uniform OBE will be attractive to a range of independent private network service providers and convenience/content service providers who will be considering strategies for provision of in-vehicle services in relationship to the VII system presumed to be operated under this program. A key issue regarding on-going management of the VII network will be governance of the use of the VII system components network by private third party service providers. This includes both third party access to the VII network as well as access via private networks and RSEs to vehicle OBEs. Many of the driver/consumer convenience services may involve third parties in partnership with one or more OEMs. Such use would, at a minimum, be governed by published standards relating to the OBE and network and to the priorities for spectrum allocation and network capacity established by the Oversight entity. It appears that there would be three additional levels of “control” (other than standards adherence) regarding third party network and/or service providers:
  - Individual OEM decisions regarding access to OBE in conjunction with the proposed private service. It is presumed that OEMs in common and individually may arrange for certain select private services to be provided in conjunction with third parties.
  - Oversight Entity decisions regarding allocation of network priorities and capacities.
  - Oversight Entity decisions regarding pricing and cost allocation.

The resolution of this issue may well affect the likely range of services offered via VII as well as the nature of private competition to the revenue services that may otherwise be made available over the VII system.

### **3. Institutional Precedents for an Operating Entity**

There are a range of specific attributes that define the needed characteristics of the entity providing continuing operations. These attributes spring from both the business and service

nature of the VII and from the need to operate on a national basis entailing federal commitments:

- Mode of Establishment – Whether the entity is a current legal convention or requires special legislation, its IRS status, etc.
- Public-Private Policy Representation – Need for legal representation of parties with agreed policies and procedures and some dispute resolution mechanism (and some withdrawal and/or sunset mechanism)
- Executive Capacity – Management, administrative, and technical capabilities to execute contracts, and conduct business
- Financial Sustainability – Operating support (financial) for continuity, drawn either from service provision revenues, Federal aid, or deals with private service providers
- Political Independence – Freedom from dependence on/interference from the political process
- Contracting Authority – For network services provision, operations, and improvements
- Ability to Receive Federal Funds – For system start up only or on a continuing basis)
- Ability to Receive Revenues – To support operations and maintenance and to upgrade technology
- National Jurisdictional Scope – with deployment along facilities, at interchanges and intersections, and at other key locations as appropriate in all 50 states, including local jurisdictions
- Freedom From Antitrust Constraints related to the mode of OEM representation and permissible span of considerations

There are few existing precedents possessing all the necessary attributes – especially the ability for a combined public-private involvement. Example entities that might involve joint public-private participation include:

- Federal Government Corporation (FGC) – A wholly-owned FGC is a corporation established with the particulars set by Congressional legislation in order to obtain certain assumed efficiencies, political independence, and financial support that come with a funded, self-perpetuating entity. Many of them look like government agencies or public utilities, but have special powers that distinguish them from agencies (e.g., succession; ability to sue and be sued, to make contracts and multi-year financial commitments, to hold property, and to borrow funds; civil service exemption and procurement exemption; off-budget). Some Federal corporations issue stock to private parties (usually called mixed-ownership FGCs) and can provide subsidized credit to particular constituencies. It may have federally appointed directors and the investors – including USDOT – may enjoy limited liability. There are 14 such FGCs currently, some of which (like the Tennessee Valley Authority, the St. Lawrence Seaway Corp, and COMSAT, etc.) are part of the Federal budget and are subject to Congressional oversight. The creation of new FGCs can raise broad and potential difficult general policy issues beyond the specified mission, but they can be tailored with many of the potentially desirable attributes.
- Public Utility – Public Utilities with monopoly rights are typically created and regulated at the state level, although many are regional and municipal to deliver services that benefit from unique single delivery institutions that can also be regulated to protect the public interest in a monopoly situation. They can be either investor- or government-owned. There are no national scale utilities, and the United States government historically has been focused on regulating, not creating, monopolies. AT & T was a nationwide, regulated monopoly that was permitted to exist despite antitrust law. TVA looks like an interstate utility, but over time has become a government corporation.

- Federal Agency – A special purpose federal agency for VII (performing functions such as the FAA) is another possibility. Unlike FGCs or the utility approach, a federal agency would not have the clear option of being self-supporting and exempt from the usual Federal agency restrictions cited above. A federal agency would be considerably restricted in the extent to which it permits private sector participation in governance decisions and activities. The relationship between FAA, the airlines and the other regulatory entities impacting aviation bears consideration. However, the mechanisms for private input are indirect may be less suitable for a service delivered with both public and private resources.
- Private Non-Profit Corporation – 501(c) (3) entities are IRS tax-exempt, non-profit entities typically employed by business and trade associations to pursue their industry interests, but they can and do provide services. AMVANET is a good example of a fee-supporting national information service providing entity which manages nationwide commercial drivers' license information systems. As a concept, AMVANET was established by legislation with USDOT designated to administer the establishment of the systems including the funding of pilot states, who then retained a contractor to develop the system with AMVA given the clearinghouse responsibility by USDOT through a "designation agreement". The support of the program eventually transitioned to a fee-based program.

While there are no known precedents of entities possessing the obvious attributes, specific federal legislation could be used to design an entity with most of the desired attributes, subject to legal constraints and lack of precedent.

#### **4. Disaggregating Oversight Functions**

Providing ongoing VII services involving the continuing support of major system components and the likely evolution of services will introduce issues requiring resolution of varying perspectives and perceived stakes in cost and market-sensitive concerns. Some of these will be policy issues impacting private or public interests, requiring consensus among the Primary Stakeholders as well as public (political) consensus. Others may involve the need to equitably allocate costs or resolve disputes. This range of issues suggests the need for an institutional approach that either (1) can accommodate the range within a single institution, or (2) may separate operational responsibility from policy and issues of a more regulatory nature.

It may be that the needed functions regarding administration of services, allocation of benefits, and resolution of disputes mix operational and regulatory functions that cannot be realistically (or legally) accommodated in a single entity – especially as actions of one partner (say the Federal government) may benefit or penalize another partner (e.g., the action of the Federal government benefiting a particular state of private enterprise).

One solution would be to separate the operational entity from policy and/or regulatory functions that could be served via an appointed board – congressional or presidential – working with a Federal agency. In fact, the range of public-private possibilities might be significantly enlarged if these functions were placed in separate entities (e.g., government regulatory arm vs. public-private implementation agency). The allocation of potential liability and definition of commercial risk-sharing among the Primary Stakeholders must be addressed in connection with the negotiation of each of these arrangements. In particular, such an analysis would help to clarify the applicability of appropriate public-private institutional precedents for the proposed Operations Oversight Entity.

These issues require further consideration.

## H. CONCLUSIONS

Exploratory Nature of this Paper – This paper represents the first attempt to identify the wide range of issues associated with the unique public private partnership and nationwide systems installation implied by VII. Recognizing the lack of precedent and the program scope, a set of key issues have been set forth which are central to success of the proposed endeavor. These issues are organized around three key challenges: the basic agreements essential to support the initial commitment of principal stakeholders, public and private; the approach to system deployment, both contractual and support actions; and, the oversight mechanism for continuing service provision. The paper recognizes that both the OEM business models (irrespective of the specifics of each OEM's business strategy) and the viability of a public sector VII program (both federal and state) are dependent on the public-private arrangements and agreements between the OEMs collectively, and the public sector. All these issues (and others to be identified) require further development.

Separation of Topics for Further Review – For efficiency sake each of the three topics – Basic Agreement, Network Services Provision, and Operations Oversight – may be pursued as separate issues. Recognizing sequence issues, it makes sense to give first priority to the Basic Agreement, followed by the Operations Oversight mechanisms. Issues related to network services provision must be resolved through further technical study before actual deployment arrangements – especially cost sharing – can be usefully considered further.

Basic Agreement Issues to be Pursued – Based on this initial review, some of the key issues meriting more detailed review and development include:

- Roles and relationships and form of representation among individual participants among the Primary Stakeholders
- Priorities and sequence regarding use cases
- Scope of system/services with vs. outside VII
- Basic systems and technology specifications,
- Specific implementation steps, staging and schedule
- Initial and subsequent geographic deployment coverage, locational and availability criteria
- Approach to cost sharing, pricing and billing among the Primary Stakeholders
- Concept for contractual approach to deployment
- Concept for oversight regarding governance as well as network service operations parameters
- Approach to enforceability of agreements and remedies
- Disposition legal issues – privacy, security, liability, antitrust
- Critical go/no go issues

Carrying out some of the required responsibilities on the public side may require certain federal and state actions to support the necessary government commitments such as legislative mandates, regulations, licensing, performance standards, tax policy, direct or pass-through funding of continuing program.

Operations Oversight Mechanism Issues to be Pursued – Operations Oversight may constitute the most complex institutional issues as they involve the need to create a continuing, sustainable capacity to operate, manage, maintain and evolve a complex service-providing system with significant reliability and security dimensions. Furthermore, the desired approach must accommodate a range of private business and public interest concerns including allocation of prices, costs and revenues, and potentially, the ability to receive revenues and public funds.

It is not clear whether a single corporate-like entity is feasible or appropriate – or whether a set of mechanisms may be necessary to conduct the several operational, regulatory, business and policy functions. In any case it is clear that the span of authority of the oversight components must be acknowledged by the Primary Stakeholders and that the governance functions must be perceived as representative and independent and maximally free of outside interference

The establishment of oversight – on a stable and sustainable basis – is in itself a significant challenge owing to the need to blend public and private representation in the face of potential legal and policy constraints. An initial review of institutional precedents suggests there are aspects of these experiences that may offer some guidance in development of an appropriate institutional vehicle or mechanism.

Next Steps – Immediate actions to move the analysis of issues raised in this paper forward may include:

- Establish separate Task Forces to pursue further development of Basic Agreement and Operations Oversight (with staff support) as soon as possible.
- Develop draft work programs – based on this paper and other inputs – as an initial agenda for the Task Forces.
- To further refine the next stage of work regarding operations oversight, a workshop should be convened assembling selected legal and policy experts with perspectives presumed to be helpful in development of government-industry program cooperation. Suggestions for participation have been solicited from the Business Model Task Force.

## APPENDIX

### BUSINESS MODEL COMPONENTS

#### A. Introduction

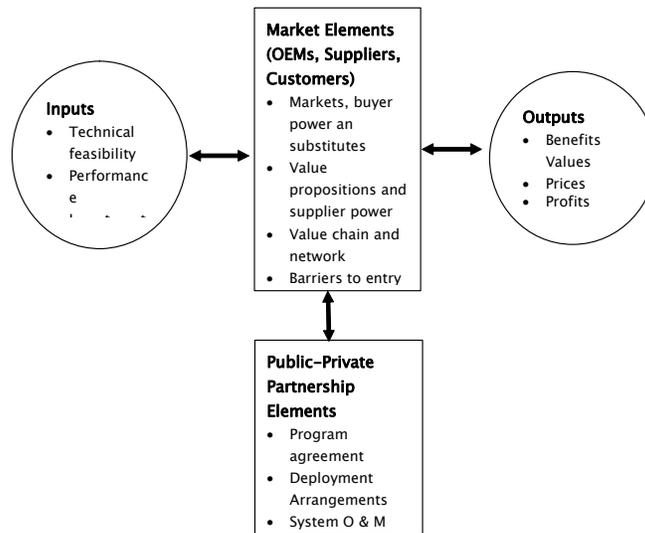
Business models are normally developed for private sector entities and focus on return on investment. In the case of VII, which is a public-private venture, return on investment includes societal benefits (e.g., improved road safety, reduced congestion, more efficient operations), as well as potential private benefits (e.g., improved private convenience and productivity services and corresponding profit potential). The VII vision includes both. Based on the understanding that by combining all potential benefits into a single business model, the net benefits are more likely to outweigh total costs. Key considerations in business models typically include:

- The Markets – Users, customers, paying or not, to whom the proposed service is useful and what purpose and how they compensate the producer/provider (directly or indirectly)
- The Value Proposition – The service and qualities offered by the producer/provider to the customer as it responds to what the customer wants and needs and how they create/maintain a relationship between service provider and customer-user
- Value Chain and Network – The sequential set of activities that the producer/provider and its suppliers perform to combine component inputs into the value-added outputs for its customers
- Cost and Profit Structure – In terms of the relationship between fixed and variable costs margins, volume on various components in the value chain
- Competitive Strategies – Including the position of the service provider in the value network including suppliers, partners and competitors and the basis of the suppliers competitive position

In addition to these conventions of business arrangements in a competitive private market, the interdependency between the private sector stakeholders (OEMs) and the public sector infrastructure owner-operators introduces the need to develop a set of public-private agreements and arrangements about their respective roles in providing and managing VII system components. This public-private partnership is an essential part of the value chain that creates the services to the OEM's principal customer base, which is also the public sector's constituency – vehicle owner drivers.

For VII to work, each of the Primary Stakeholders must be party to one or more types of value-added transaction activity that, in combination, comprises VII. Some of these are pure business relationships by contract, while others are broader cooperative agreements at the industry-government and government-to-government level.

Figure 3 illustrates the key business model dimensions.



**Figure 3: Business Model Dimensions**

Each of the Primary Stakeholders has a characteristic set of concerns that must be addressed in their business models.

The OEMs see VII as a business in the context of financial returns on investments involved in offering new service features to vehicle buyer/owner/drivers. There would be a specific business model for each. For example, safety and vehicle diagnostic features may be built into vehicle prices, whereas traffic information, map updates, and other services may be offered as options on a subscription or transaction basis. Other third party private service providers working with or through the OEMs may have access to vehicle owner-drivers for service provision. These services may also be based on differing business models involving the service providers, driver-owners, and OEMs. In addition, outside the framework of VII, other communications systems may also provide direct access to drivers (potentially competing with the services offered through the VII system). Additional private entities are likely to be involved in developing a range of applications for both public and private users.

Federal, state, and local government transportation agencies are also key players in VII. They too, have value propositions. First, the sponsoring government agencies must make a convincing case – especially in safety and mobility terms – to their constituencies, in order to gain policy and program authorization before proceeding with public investment for VII. Secondly, their VII-related actions and investments may be based on understandings and agreements with OEMs which, while non-commercial and non-contractual, are nevertheless based on good-faith mutual commitments embodied in specific program actions. Thirdly, public sector players may also enter into direct commercial contractual arrangements for implementation with private sector entities (such as network services providers) that may involve cost-sharing elements. The public sector entity could take several forms, involving Federal-state-local participation. For purposes of this deployment discussion it is assumed that the Federal government takes a lead role, acting on behalf of the public sector.

Each key stakeholder therefore is likely to have several value propositions and transaction-like agreements, both formal and informal, related to the range of services. Therefore, there is no

single business model. Many key variables within the various business models will remain unknown until deployment specifications are developed to a greater level of detail. Furthermore, given the competitive context, specifics regarding individual OEM or related private service provider products, services, cost and profit structure, and competitive strategies are unlikely to be publicly available; so general models will have to be based on reasonable assumptions.

## B. VALUE PROPOSITIONS FOR VII BUSINESS MODELS

VII as a concept is both a set of public services and a set of businesses. Bringing this concept to reality involves multiple private sector players in several industries (e.g., OEMs and their suppliers, communications/network hardware and service providers, consumer service providers, etc.), and the public sector (Federal government, and multiple units of state and local government). Development of VII as a program involves each of the several stakeholders in multiple business or program relationships that in turn imply one or more types of value-added transaction activity that fosters that relationship (the “value proposition”). As a result there are different business models for the various key stakeholders.

### 1. Key Elements

At a high level, key elements of the several value propositions are evident. Most of the value propositions involve the establishment of entirely new services, or new levels of existing services. Each of the Primary Stakeholders has characteristic value proposition:

- The OEM value proposition involves a commitment to rolling out compatible OBE on a given schedule in return for a public sector commitment to supply the infrastructure necessary to support a national market for the range of services that the OBE may support that, in turn, justifies the OEM investment. The public sector will also be expected to utilize the anonymous vehicle data in providing certain services (e.g., safety and traffic data directly back to the vehicles over the VII network). OEMs will develop products and services with a range of automotive and electronics component suppliers within their own proprietary value chain. OEMs may also be involved with third party services suppliers in providing a range of other basic services provided to all vehicle users such as telediagnosics, safety and recall notices. However, given the competition among OEMs and their prospective third party service provider-partners, as well as their proprietary interests in varied service offerings, full and open discussion and analysis is not appropriate. Some of the returns-on-investments for OEMs will be indirect, through the ability to influence customer brand selection and reduce churn by using continuing service to maintain continued customer loyalty, as well as to develop new sources of fee income. For OEMs, widespread availability of VII supports transitioning vehicle-customer relationship from product delivery towards service platforms.
- The public sector value proposition involves providing the initial RSE and backhaul communications in order to obtain the significant future safety payoffs that cannot be obtained through infrastructure improvements alone. VII is also presumed to substitute for other more expensive infrastructure-based approaches to traffic management, both existing and contemplated. The business model under discussion in this memo also assumes that the cost of initial infrastructure deployment and initial applications will be borne by the Federal government, with the consent and support of state DOTs, combined with cost-sharing from a private network services provider contractor in return for access to certain system components. In addition, some states may eventually

undertake applications beyond an initial common set, either individually, in pooled arrangements, or as public-private partnerships.

- Third party commercial service value proposition involves providers including those involved in both network services and other driver convenience services. One major third party transaction will involve providing network services – in this model presumed to be a contract with the Federal government (with possible private cost-sharing). A range of other possible commercial transactions between third party private service providers and either OEMs or the transportation agencies is expected to provide a range of public service applications and consumer services.
- The customer (vehicle users) value proposition is based on an assumption (by both government and private sector are assuming interest in the safety and mobility services expressed both through support for the VII program and via and an interest in new vehicle features, including, in some cases, a willingness to pay for premium services.

## 2. Value Propositions among VII Stakeholders

There are two ways to examine these issues and their implications. Table 1 suggests basic assumptions regarding the service-offering/service-consuming relationships among the various key stakeholders that constitute a set of linked value propositions that must be more-or-less satisfied if VII is to be a success in terms of outcomes. Each stakeholder, public and private, has some kind of relationship with other stakeholders. Many of these are pure business relationships among the OEMs and their suppliers or business partners and customers. Others must be forged as formal agreements or mutual commitments between public and private sector stakeholders.

Table 2 builds on the value propositions of Table 1 and places them in a more conventional business model framework for each of the major stakeholders. Each has target markets or partners at the individual customer or institutional level with whom it has a value proposition. Each has a specific source of profits or benefits that flow from the value proposition in relationship to a given market. While many specifics cannot be identified at this time, some of the key threshold issues can be identified that are presumed to be basic preconditions to business success and that must be worked out in some kind of public-private arrangement or agreement.

**Table 1: BASIC HIGH LEVEL VII VALUE PROPOSITIONS AMONG STAKEHOLDERS  
(Between Parties As Represented By Row And Columns)**

<b>STAKEHOLDER AS PROVIDER/ CONSUMER</b>	<b>OEM</b>	<b>FEDERAL GOVERNMENT</b>	<b>STATE/LOCAL GOVTS</b>	<b>VEHICLE OWNERS, DRIVERS, OCCUPANTS</b>	<b>3<sup>RD</sup> PARTY SERVICE PROVIDERS</b>
<b>OEM to:</b>	Reliable commitment to limited but sustained cooperation to establish nationally standardized and stable basis for DSRC-based safety services and common mobility services	Reliable collective commitment to defined and sustained cooperative arrangements via vehicle-based investment to establish/maintain standardized and stable basis for DSRC-based safety and mobility services	Commitment to mutual and sustained participation in separate roles to provide safety and mobility services to vehicle owners	Offer new VII-based safety, mobility and other branded services in return for buyer , expenditures and in return for limited access to vehicle data – both basic anonymous data and contractual access for vehicle services	Partnerships to generate and share new sources of branded commercial service revenues, under specific voluntary, contractual agreements with vehicle owners
<b>FEDERAL GOVERNMENT to:</b>	Reliable Partnership commitment via partnerships with state/local governments to provide funding and institutional support for infrastructure provision and to provide basic mobility information	NA	Reliable commitment to provide Federally supported VII infrastructure and applications for state/local safety and mobility programs as cost-effective substitute/supplement for other programs	Commitment to meeting national policy goals via VII program as cost-effective means of improving driver safety and mobility	Cost-sharing partnerships to reduce Federal investment requirements in VII infrastructure  General support of private investment in VII (applications, etc)
<b>STATE/LOCAL GOVTS to:</b>	Commitment to utilize Federal resources to support provision of local and networked safety and mobility functionality and to provide basic mobility information	Commitment to utilize Federal resources to support provision of local and networked safety and mobility functionality and to follow common national guidelines	Possible state/state cooperation through pooled funds for future specialized applications	Provision of local and networked safety and mobility functionality in systems operations	Partnering to reduce cost of public services and promote new investment
<b>VEHICLE OWNERS to:</b>	Provide political and social support for VII at local, state and federal level and evidence willingness to pay for certain services	National constituent support for Federal investment in pursuit of significant safety and mobility improvements	Expectations/ support of state program to capitalize on Federal/OEM investments to secure significant safety and mobility improvements	Expectations of equipped vehicles for system participation	Provides customer base for new affordable commercial services
<b>THIRD PARTY SERVICE PROVIDERS to:</b>	Partners in provision of new customer services on an individual (competing) OEM basis	Partnering to reduce cost of infrastructure provision and operations	Partnering to reduce cost of state local services	Provision of new commercial services and revenues	Potential partnering for mutual gain

**Table 2: BUSINESS MODEL FRAMEWORK**

STAKEHOLDER	VALUE PROPOSITION	MARKET	SOURCE OF PROFIT, BENEFITS	RELATED TOPICS FOR ARRANGEMENTS AND AGREEMENTS	
				THRESHOLD ISSUES	FRAMEWORK ISSUES
<b>OEM</b>	<p>Improved cost-effective safety systems</p> <p>Increase value of car to buyer</p> <p>Provision of new CRM features</p> <p>Differentiation based on services</p> <p>Transition to vehicle as source of service revenues</p> <p>Industry cooperation in establishment of national market</p>	<p>New vehicle and service purchasers</p> <p>Third party service providers</p> <p>Telecommunications industry</p>	<p>Increased point of sale revenue</p> <p>Decreased warranty costs</p> <p>Increased market share of in-vehicle service revenues</p>	<p>Staging up fleet penetration</p> <p>Limitations of benefits\liability</p> <p>Consumer acceptance risks/uncertainty</p>	<p>Stabilize technology</p> <p>Provide access to customers</p> <p>Maintain competitive advantage</p> <p>Avoid/manage unintended consequences (inequities, abuse of agreements, etc.)</p>
<b>FEDERAL GOVERNMENT</b>	<p>Capitalize on cost-effective national investment strategy to improve safety and mobility</p> <p>Provide basis for future VII programs</p>	<p>Direct: state and local government</p> <p>Indirect: road users</p>	<p>Unique reduction in injury, fatality rate</p> <p>Reduced congestion</p>	<p>Securing public buy-in (political and social support for deployment)</p> <p>Assurance of in-vehicle system component rollouts</p> <p>Avoidance of preferential treatment</p>	<p>Establish national market for service</p> <p>Provide sustainable resources</p> <p>Avoid/manage unintended consequences (inequities, abuse of agreements, etc.)</p>
<b>STATE/LOCAL GOVTS</b>	<p>Improve safety and mobility</p> <p>Improve traffic/incident management</p> <p>Avoid costs of detection &amp; surveillance instrumentation</p> <p>Avoid costs of planning/design data collection</p>	Road users	<p>Unique reduction in injury, and fatality rate</p> <p>Improved traffic management</p> <p>Cost avoidance in data gathering, operations equipment deployment, O&amp;M</p> <p>Reduction in EMS operations</p> <p>Reduction in construction cost delays resulting in more efficient operations</p>	<p>Requirement to oversee deployment on local government R.O.W.</p> <p>Assurance of USDOT provision of initial applications</p> <p>Fees charged for continuing O&amp;M</p>	<p>Establish Statewide availability of service</p> <p>Inter-governmental relationships</p> <p>Securing individual state and local government commitment</p> <p>Avoid/manage unintended consequences (inequities, abuse of agreements, etc.)</p>
<b>VEHICLE OWNERS, DRIVERS, OTHERS</b>	<p>Improve safety and mobility</p> <p>New services</p>	NA	<p>Reduced risks &amp; associated costs (insurance)</p> <p>Improved LOS</p> <p>Cost of added vehicle attributes</p>	<p>Cost of new equipment</p> <p>Privacy/civil liberties</p>	<p>Provide new products, services</p>
<b>THIRD PARTY SERVICE PROVIDERS</b>	<p>Increase customer base for existing services</p> <p>Develop new services</p>	Driver-related service providers	Additional customer base	<p>Access to vehicles, drivers</p> <p>Limited scope of services that can be offered without contractual arrangements with OEMS</p>	<p>Provision of access to customers</p> <p>Liability apportionment</p>

Given these uncertainties and complexities that surround these issues at this point in the development of VII, specifics (quantities, market shares, costs and cost sharing, prices, willingness to pay, etc.) that must be part of any Primary Stakeholder's business model cannot be precisely defined. Therefore, the focus of the body of this paper is not directly on business models themselves, but on the framework of agreements and arrangements that are likely to provide the highest value services and reduce uncertainties and risks for all parties. As additional information becomes available regarding deployment configuration, costs, market penetration rates, etc., full business models can be developed.