

A Federal Update on Intelligent Vehicle Highway Systems (IVHS)

Lyle Saxton

Chief, Advanced Systems Division
Federal Highway Administration

President Bush recently announced a new National Transportation Policy (NTP) for the United States. The NTP identified six major goals or points. The Intelligent Vehicle Highway System (IVHS) program has major contributions to most of these particular goals. IVHS is particularly important to the last goal, which says advance transportation technology and expertise. Here, IVHS is called upon as a major part of the Federal Government's program to deal with traffic operational needs of the future. In that context, it is a program that already has the support of the Department of Transportation, the Federal Government and many state and local governments.

What are some of the problems that we're trying to deal with? As many transportation officials have no doubt seen, traffic demands continue to grow. The continuing trend of the number of licensed drivers and the number of registered motor vehicles is, in fact, soaring with no flattening of the curve. No one knows just how long this will continue. Given that increasing trend, we're also seeing a growth in vehicle miles travelled (VMT). Urban growth and urban VMT is increasing even faster than rural growth and VMT. In fact, 1988 was a magical year, for that was when we reached two trillion vehicle miles of travel in the United States.

I would like to point out an interesting point about VMT. If you drop back to around 1970 and look at the projections, you'll notice that we have continually underestimated the growth in VMT. It has been bad enough in our estimates but, unfortunately, it has always been worse in reality. What's the result? Congestion. It's not in every city in the United States. It certainly isn't in the smaller cities. But the problem is growing, and it's happening in cities that a few years ago were relatively major cities that had not experienced congestion. I'm not here to tell horror stories but, quite frankly, you can be assured that congestion is going to continue to grow and continue to engulf more cities.

The problem, however, is not just congestion and urban issues, it is also safety. Fortunately, in the United States, the fatality and accident rates have been trending downward. If not, we would have many more than the 45 to 50 thousand fatalities a year that we've had over the last few years. Given the fact the traffic volumes are growing, though, even with the fatality rate decreasing, we still see an inordinate amount of actual fatalities. The problem I think we're faced with is that those curves are starting to flatten out a little bit. So we need new ways of attacking the basic fatality and accident rates — Especially in rural areas.

How do we improve our accident rate? Clearly the best way is to do a better job of installing systems with high design standards. We know that the interstate,

with its high design standards, is obviously much safer than a two-lane rural road. Obviously, we cannot afford as a nation to build all two-lane roads to interstate standards. IVHS offers some potential to provide devices on the vehicle in the future that will atone for some safety deficiencies. IVHS may help alleviate those deficiencies that we don't have the money to correct on every two-lane road and trouble spot.

Many of the problems are human failure, and that's understandable. As we look to the future — and by my introduction you might have guessed I'm a little concerned about this particular issue — we see that the number of drivers over the age of 55 will double by the year 2000. Travel, overall, will increase by 50 percent, there will be some real problems in the suburbs.

What are the solutions? I want to emphasize the plurality of the word "solutions." I don't want you to think that I believe IVHS is the only answer. Quite the contrary. There are so many problems and operational issues, it will take a concerted, broad-band set of solutions to deal with them all. But one solution is the application of new technologies. This is an area we have not put an emphasis on in the past. I think we can in the future.

IVHS, stripped of all the veneer, stripped of all the hocus-pocus, is simply the application of electronic communication and control technology to highway operational needs. It represents a major part of the evolution of the highway operation system. IVHS is the same type of technology that you use and take for granted in your business place and in your home. We are trying to bring it to highway operational needs.

Let me relate a quick overview of the program. We are using the traffic control centers that we have in many of our urban cities. We are attempting to increase the ability of these centers to have adequate surveillance, and to provide information back directly to the vehicle and to the driver inside the vehicle. There is also a major commercial vehicle component, as well as some control technology for future control systems. By and large, this is the kind of system that we're talking about.

Mobility 2000, an ad-hoc group that has sought, over the last few years, to define the scope of the IVHS program, has described these general areas of the program: Traffic Management Systems, the In-vehicle Driver Information and Traveller Information Systems, Regulatory Operations that can be improved and enhanced, commercial fleet operations in the area of vehicle operations, and advanced vehicle control systems.

A main tenet, or foundation, of this program is that it is not a federal program by itself. In fact, this is a partnership program, and we are dealing more closely with the private sector than we ever have before in the IVHS program. This teamwork and these partnerships, or joint ventures, are a cornerstone of the operational tests I will describe.

I have mentioned that operational tests are a major component of the program. I now want to offer a little background on our work. As you might suspect, the title is somewhat descriptive. The performance of many of these developmental systems under actual operating conditions will help make that transition from research and development (R&D) to full deployment. The joint ventures with manufacturers take place during this transitional phase. The industry develops particular hardware that incorporates various concepts. We then

bring in the state and local governments to attack certain operational issues and determine how well the technology works in that particular environment. For these joint ventures, the Federal Government has funding that has been coming from Congress, and we are able to participate up to about 50 percent for those ventures we have an interest in.

One other item the Federal Government brings to this program is a national perspective. We try to evaluate the various operational tests performed around the United States from a common perspective. Therefore, we can give a balanced national evaluation that is beneficial to both you and to us. There are many operational tests already underway, in fact. I would say there are roughly fifteen that we would count in this category. Discussed below are some of the more famous tests.

Illinois Advise is a major In-vehicle Driver Information System (IDIS) being proposed. In fact it's actually beyond that stage. We are now working on a memorandum of understanding between Illinois DOT, the Federal Highway Administration, Motorola and the University Consortium. Advantage I-75 is a system that will be similar to the HELP/Crescent program.

One of the down sides, as I mentioned earlier, is that if you look at advanced traffic management systems around the United States, you would find a number of major urban areas that don't have state-of-the-art systems. There are nearly forty major cities in the United States with a population of one million or more. I think it's fair to say that only ten to fifteen of those metropolitan areas, have what we would consider a truly modern traffic control system for freeways and signalized networks. But, there are a number of smaller cities that either have an excellent system or are in the process of updating their current system. This use of existing technology in advanced traffic management systems is the foundation for all of the other activities we want to do in the IVHS program.

Another interesting project is the so-called smart corridor in Los Angeles. It's an approximately fifteen mile corridor around the Santa Monica Freeway. The importance of the smart corridor is that it is more than just the operation of the freeway. We are looking at the overall corridor and trying to operate that corridor as an integrated system. We not only want to know what is happening on the freeway. We want to know what is happening on all the parallel, major arterials in that corridor, which is five to seven miles wide.

The Smart Corridor project is also seeking ways to provide that information to motorists. If we can inform them of the traffic conditions, we can divert them when necessary, and thus balance the demand throughout the corridor, and not just on the freeways. I've driven that particular Santa Monica Freeway many times. In stop-and-go traffic, I could see free-flow conditions on some of the parallel arterials.

This better utilization of present resources is one of the cornerstones of the IVHS advanced traffic management approach. Beyond the Smart Corridor, we also want to bring on line a major new traffic control system for signalized networks. Los Angeles has, probably, the most up-to-date system in the United States. This is due, in part, to Pathfinder. Pathfinder, a project we started two to three years ago, is sort of the grand-daddy of in-vehicle driver information systems.

Pathfinder is a joint venture between General Motors, the Federal Highway Administration and the California Department of Transportation. It is an attempt

to get a first-hand view of how drivers will use navigational and guidance information presented to them inside the vehicle. It is a very simple approach. In fact we didn't design specific hardware. Instead, we took existing hardware and put it together to get this initial project started.

Pathfinder uses an ETAC navigation system. That Etac system is commercially available as a stand-alone navigation system. There is no communication and no congestion information, but it does give you an electronic map and navigation capabilities. The screen is designed so that the driver's location is always in the center. The screen actually rotates around, so that the direction you're headed is always pointing up on the screen.

Today, we have added a new, very major dimension to the Pathfinder Project. We have added the pathfinder technology into the Smart Corridor network. We can take the freeway and arterial traffic conditions, and fuse it with all of the information from other surveillance sources — such as the highway patrol — at the control center. Then, we electronically package that information and communicate it to the vehicles equipped with the in-vehicle displays. Currently, there are twenty-five of these vehicles.

What the driver (the experimental subject) sees is an ETAC map of the area with additional arrows displaying current traffic conditions. Some of the arrows are filled in and others are blank to show either moderate or major congestion. No recommendations are given to the motorist as to a preferred route. Rather, the motorist can see where he is on the screen, and what the traffic conditions are on the route he intends to take. Motorists can use that information to determine whether to stay on the freeway or take an alternate route.

This project is currently running. Beginning in May of 1991, we will begin serious evaluation with experimental subjects. The project will run for a year, and then we will have the results of this very interesting field operational test.

Another project that is in an evolutionary stage is Trav-Tech. Trav-Tech is sort of the next generation of In-vehicle Driver Information Systems. It also uses a screen, but Trav-Tech has the additional capability of displaying a dotted-line trajectory. Like the Pathfinder, Trav-Tech provides navigational information to the driver, which is based on surveillance information from the control center. But, the control center also runs a routing algorithm, and provides this information to the driver as a proposed best route. So, unlike Pathfinder, which simply provides traffic information, Trav-Tech goes one step further, providing, under certain conditions, a recommended best route.

Trav-Tech also has other important features that set it above and apart from the Pathfinder approach. Trav-Tech provides a kind of yellow pages for the driver. It stores information on hotels, tourist attractions, etc. on a CD-ROM inside the vehicle. This information is then virtually at the fingertips of the driver. If you're looking for a place to fix your car, Trav-Tech can give you a listing of mechanics in the area.

The Trav-Tech hardware is being designed by General Motors through the Delco Corporation. Trav-tech is well on its way to completion, and we plan to begin the evaluation in January or February of 1992. This project will run for a year on roughly 100 vehicles. Seventy-five of the one hundred vehicles will be rental cars made available to AAA members in Orlando, Florida. AAA is part of the partnership, and they will be getting participants for the project. So, for a normal

rental rate, vacationers will be able to involve themselves in this project to see if Trav-Tech is worthwhile.

Next I would like to discuss commercial vehicle operations. Most transportation officials have heard of the HELP/Crescent project. The needs of commercial truckers are extremely important in the IVHS program. Both from a point of view of fleet management and improving efficiency. One way to improve the efficiency of commercial trucking operations, as well as the efficiency of state highway operations, is to improve the efficiency of regulatory operations.

HELP is intended and designed to deal with this particular issue of improving regulation by working primarily with automatic vehicle identification. Transponders can be placed on commercial carriers. With these transponders, the truckers can be electronically interrogated. Then, if the weight, permit status, and other characteristics of the carrier are in order, he will be allowed, under certain conditions, to bypass the weight station and continue on toward his intended destination.

In more advanced systems, instead of just a simple AVI reader, which gives you not much more than an ID tag, future versions are intended to have two-way communication capability to the roadside. Eventually, the on board equipment will become more and more like a computer, so that it will actually be able to do some calculation. This will be even more important when we get into situations where we are trying to give additional service to the user.

For example, we will be able to determine hours of operation by the particular driver, where he stopped, and how long he was stopped. A number of fleet operators want that kind of information. This will also be important for regulatory operations, because we can put the permit status and numerous other pieces of information into the computer and update it at various stops. This projects holds promise for some major improvements in commercial operations on our highways.

The objective is to save time and fuel, improve efficiency, and enhance safety. The goal set by Mobility 2000 is to have the entire interstate and approximately 50 percent of the non-interstate national truck network instrumented with these type of systems by the year 2000. Then, we will have a truly broad-based national network of this capability.

Now let me give a brief description of IVHS America. Mobility 2000 was an ad-hoc organization that bonded together over the last two or three years and developed some goals, objectives, and scope for the IVHS program. They quite frankly networked together a number of organizations and people into what has become the IVHS program. One of the objectives of Mobility 2000 was to develop a basis of support and need for a formal organization. That formal organization has now been established and incorporated as IVHS America.

IVHS America is a public/private not-for-profit corporation. The incorporators consist of the Highway User's Federation and AASHTO. IVHS America is and will be a permanent organization. It will provide the important role of bringing together national coordination and communication for the advanced technology program. The Federal Government has also established a charter that utilizes IVHS America as a federal advisory committee. By establishing them as a federal advisory committee, we can seek advice on the IVHS program from this group and participate fully with them. This will bring federal participation and partnership into IVHS America.

One of the major activities of IVHS America is to develop a more detailed strategic plan. I briefly described the HELP/Crescent goal created by Mobility 2000. There are similar goals in advanced traffic management systems, travel information, and advanced vehicle control. Systems architecture is extremely important. How do you make all these items fit together so that the systems can communicate through the same mechanisms. We need to develop standards.

Let me briefly describe how IVHS America will function. There is an executive committee elected by its membership, a coordinating council, which is a permanent group of about thirty to thirty-five members who will oversee the technical committees, and the technical committees themselves. The technical committees are the real role of IVHS America. Each committee will be established as needed and disbanded when its function has been served.

Initially we are proposing approximately nine technical committees in the conventional areas I mentioned earlier. These include: systems, safety and human factors, systems architecture standards, Advanced Public Transit Systems, and evaluation and benefits.

Let me summarize by restating some of the goals we would like to reach with IVHS by the year 2010. I mentioned that the forty major cities in the United States do not have up-to-date, advanced traffic management systems. Quite frankly, the goal is to have all 250 of our major cities equipped with truly advanced traffic management systems. In the area of ATIS, or traveller information systems, the goal is to provide in-vehicle driver information and navigation capabilities in at least the major cities. As I mentioned, in commercial vehicle technology, the goal is to get the interstate and most of the national truck network implemented.

I didn't go into a discussion of advanced vehicle control, but there are numerous opportunities here. Some see this as an extremely promising area for in-vehicle safety improvements. Some advances may be in radar breaking topic capability, blind spot radar detectors, on board signing and warning systems, and fog detection and warning systems. Full automated control is still another area.

In conclusion, let me talk about the federal commitment to this program. We began a couple years ago funding our work simply with our R & D budget. It was about \$2.5 million a year. In 1991, we requested \$13 million from congress for an R & D and operational test budget for IVHS. Congress gave us \$20 million. This is fairly unheard of in my business. In 1992, we have a request, that is now before congress, for \$50 million for the R & D and operational test components of IVHS.

What are we using that money for? Well, the R&D is obvious. R&D is about one-quarter to one-third of our funding. But those operational tests that we are normally funding jointly with other partners, who fund typically up to about 50 percent, are really the cornerstone of the IVHS program. This is a very vigorous program. It's not Buck Rogers. We are simply trying to take advantage of the technology we have available to us and apply it to increasingly severe operational problems.