

## **Mobility 2000 and the Roots of IVHS**

**By Lyle Saxton**

The Intelligent Vehicle Highway System (IVHS) program is a major new national program which has dramatically come of age in the last five years. Internationally, similar events have also occurred in both Japan and Europe. However, what may be suspected, but not be well known, is the substantial historical context or roots from which IVHS evolved. These roots include early research activities by university and industry and a substantial research program similar to IVHS which was undertaken in the 1960's by the federal government. They also include a changing national context during the 1980's which increasingly encouraged an IVHS program. Finally, they include certain key actions which, looked at from today's vantage point, turn out to be important strategic building blocks in this most recent, highly successful establishment of the IVHS program.

### **Early Program Activities**

In the 1960's the Bureau of Public Roads (BPR) of the Department of Commerce, the predecessor to the Federal Highway Administration, undertook a major new research and development initiative to improve the safety and efficiency of highway based travel. The program was a startling demarcation from past research activities sponsored by this organization, both in size, vision and content. At the core of the this new effort was the premise that existing and evolving modern electronic communications and control systems could be applied to vehicle/highway operations in ways which would substantially benefit the nation and the user.

And why not? The world and the United States in particular, was heady with new technology. We were in the space age and had been getting weather pictures since the launch of the first TIROS weather satellite in 1962. Now we were also committed to put a man on the moon by the end of the 1960's and were well into this manned space flight program. And we had modern semiconductors and the transistor as a basic enabling technology. The transistor had fundamentally different amplification characteristics contrasted to the vacuum tube which provided for its small size and low power. And its availability and performance was now expanding at a dizzying pace. Large and powerful transistor based mainframe digital computers were available and the software sciences were evolving rapidly. The consumer had color television, microwave ovens (although expensive) and transistorized portable radios. Given this technology context, it seemed obvious that the nation should gear up a major program to realize projected benefits in highway transportation which would derive from the application of this same basic technology.

At the leadership focal point of this major new program were a few key people Robert Baker was the Director of Research and Development and was a prime mover in this initiative. Baker was not a long time career employee of BPR having come from Ohio State University to BPR in the early 1960's. Dr. William Wolman was a mathematician who had been recruited from NASA and was the Chief of the Traffic Systems Division which was the organizational for a point of this program. Lyle Saxton was recruited from NASA by Wolman in 1968

to bring electronics and system expertise to the program. Frank Mammano and Burton Stephens are two FHWA employees still with FHWA who had major roles in this program.

Probably the best known system to be remembered from this program is the Electronic Route Guidance System or ERGS. It projected a major leap forward in highway operational performance and driver assistance. It envisioned providing the individual driver with routing guidance which not only was based on the best physical route, but was also based on real time traffic conditions. Selected intersections, strategically located throughout street network would be instrumented with roadside hardware which included communications with passing vehicles over inductive loops, communications with a central computer over hard wire capability, and a limited buffer storage and processing display. Vehicles would have on board displays, possibly even a "heads up an inductive loop based two way communication capability and an encoder for inputting your destination.

But ERGS was only one of many visionary new systems. Another major activity included the Urban Traffic Control System (UTCS) which would revolutionize network traffic signal control by interconnecting individual signalized intersections to a central control center. Here a mainframe digital computer would control the entire network by selecting the most appropriate timing pattern from a family of precomputed timing plans which had been optimized for different sets of traffic conditions.

The Passing Aid System (PAS) was intended to bring a new level of safety and driver convenience to rural two lane driving. It would provide a signal to the driver as to whether or not there was oncoming traffic and, thus, whether it was safe to pull out of your lane and pass another vehicle in a two lane road driving situation.

Other significant projects included a system to assist in freeway merging situations; FLASH, a system for motorists to signal when they observed a disabled motorist; a roadside radio motorist information system; a major activity to model the overall processes and functions of highway travel; and a project to develop a fully automated highway system. An excellent summary of many of these technologies exists in a special issue published in 1970 by the Institute of Electronic and Electrical Engineers.<sup>1</sup>

Substantial programs were mounted and resources applied to research, develop and field test these various new systems. ERGS was actually tested in two Washington DC area intersections, PAS experimentation was carried out along 15 mile rural setting in Maine, FLASH was evaluated in central Florida, the freeway merging aid system was tested in Tampa, Florida; AHS experiments were performed on test tracks and unopened Interstate lanes; and UTCS was installed and became operational on approximately 300 intersections in Washington DC.

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<sup>1</sup> Special Issue on Highway Electronic Systems, IEEE Transactions on Vehicular Technology, Volume VT-19, February

Industry and university, too, were involved in selected research aimed at using advanced electronics technology to enhance highway and motorist performance. General Motors, most notably, sponsored early research with the Radio Corporation of America on automated highways. GM also was an early pioneer in in-vehicular motorist information and assistance systems. Robert Cosgriff, then with Ohio State University, was active in similar projects.

One broad transportation strategy was also developed by the US Department of Transportation (US DOT) during this period. An energetic program focused on the needs of the Northeast Corridor was prepared during 1970 and published in May 1971.<sup>2</sup> The 1970's action program included "development and implementation of a real-time highway information system to assist intercity drivers in making route choice decisions". The longer term program was focused on automated highways and included two recommendations "to provide alternatives to continued proliferation of conventional highways". The recommendations were:

1. Expansion of the automated highway research and development program to define and evaluate possible concepts:
2. Preparation of proposed legislation for the Post Interstate Highway Program which will permit highways to be planned and built in such a way that accommodation to automated capability will be possible.

But necessary major policy and funding support for a full blown national program did not develop. ERGS specifically was terminated when it's budget request was not approved by a congressional appropriations committee in 1971. Other projects generally did not proceed beyond the early concept evaluation phase.

### **Intervening Years**

During the remaining 70's the FHWA did continue a modest level of research in some of the IVHS areas. The Traffic Systems Division continued important research in traffic operations, motorist information and communications, and automated highway systems. Some specific examples include preliminary work on in-vehicle safety hazard warning systems, initial development of a family of traffic simulation models, a television based wide area detection system, and advanced highway advisory radio. The research program also was instrumental in working with the Department of Interior and the FCC to establish the Traveler's Information Service which allows for the operation of Highway Advisory Radio stations on 530 and 1610 kHz.

Starting in 1981, however, there was a further dramatic downturn in IVHS type research. A new President was elected and with his administration came new policies and political appointees who were generally opposed to advanced research activities and certainly did not support IVHS type activities. Thus the early 80's became a low point in staff morale and agency productivity

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<sup>2</sup> Recommendations for Northeast Corridor Transportation  
DOT/TPI, May 1971

towards the development of more advanced motorist information systems and vehicle control technologies. This lack of longer research program support on the part of this new administration also translated into minimal support for underlying research in supporting areas such as human factors and computer modeling.

But broader national and international events were occurring which would result in a resurgence of activity. Congestion was becoming a much more serious national concern. Japan. IVHS type projects were continuing in Europe and Technological advances were occurring rapidly in semiconductors electronics, and computers. Cellular telephone was now operational, the age of the personal computer and networking was emerging, and there was a growing realization by society that these advanced systems were, in fact, much more near term than had been previously thought.

The dominant national problem which looked to IVHS type systems for help was congestion. While IVHS always had the potential for safety and other the mid-80's resurgence of interest was focused on congestion. Total VMT had doubled since the late 60's and the percent of peak hour traffic on urban Interstates which was congested had now exceeded 50%. Jeffrey Lindley of the FHWA's Traffic System Division had performed a staff research study published in 1986 which identified the top US cities with the greatest congestion and also made estimates on total urban freeway delay then as well as predictions for 2005.<sup>3</sup> The results were picked up by the national press and received wide publicity.

Efforts had also been continuing to develop a much more aggressive traffic operations national research program. The FHWA's Traffic Systems Division had formulated a proposal for a major "R&D Program In Traffic Operations To Combat Urban Traffic Congestion" which emphasized seven major initiatives including navigation and vehicle control. State DOT's for their comment. This program was formally submitted to ten Also, in March, 1986 the TRB hosted a workshop in Baltimore, Maryland which would lead to a broad, multi-year traffic research effort under NCHRP 3-38. Many of the subsequent leaders in Mobility 2000 and now IVHS were participants in those deliberations.

### **Re-emergence of National Interest**

The event which is broadly accepted seen as the pivotal meeting in bringing about a resurgence of national interest and support for what has become IVHS occurred in the Fall of 1986. The California Department of Transportation (Caltrans) had been examining its needs for future construction and funding requirements. Their studies had resulted in some very unnerving predictions that no realistic construction program could maintain even the present levels of congestion. Further, State gasoline tax increases to support such efforts would be unacceptable. Given this reality, Caltrans sponsored a three day conference for its mid and senior level managers in October, 1986 to consider the role of advanced vehicle-highway technologies in meeting growing

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3 Quantification of Urban Freeway Congestion and Analysis of Remedial Measures, Lindley, FHWA/RD-87/052, October 1986

congestion. Several outside experts-were invited as speakers and participants. John Vostrez of Caltrans and William Garrison of the University of California at Berkeley were two of the principals in organizing this crucial event. The conference became a watershed for IVHS as it established a new level of national credibility and interest in these systems. For example, Richard Morgan, then FHWA's Executive Director was also a participant and subsequently took various actions which were instrumental in this national reawakening to IVHS.

Following closely on the conference, ad hoc national efforts were initiated to follow up on this rekindled interest. For example, FHWA research hosted a small group in December, 1986 which laid the foundation for the Pathfinder project as a joint cooperative undertaking between Caltrans, General Motors, and the FHWA. William Spreitzer of GM, who had also been at the Caltrans Conference, was one of the principal leaders in this early effort to evaluate a motorist navigation system.

On a broader front, there were beginning efforts to develop a national consensus group to set goals, scope and a vision of where this reemerging national interest might go. This activity quickly attracted a core group of 20-25 individuals from government, university and industry. Their common denominator was a current involvement in highway transportation and a sense that a major national window of opportunity was now opening for what was to become known as IVHS. Their mutual agenda recognized a need to articulate the national highway transportation needs which would benefit from this program, broad program activities which should be undertaken and, most importantly, to move to some form of permanent program coordination arrangement. In retrospect, this core group has been amazing in that it is still essentially intact and remains as central principals in today's IVHS program.

As before, these activities were occurring in a national environment which was becoming increasingly supportive for a new program. Considerable national effort was being focused on thinking and planning for an anticipated major change in the nation's highway program which would be occasioned by the next highway authorization legislation. This impending legislation was to define the post Interstate highway era and there was almost universal support for programs with "vision" which would extend the efficiency and effectiveness of the existing physical highway system. FHWA was internally devoting considerable resources to a loosely structured process to develop position papers on an assortment of "futures" topics which would help describe the setting and needs for the future highway program. Three of the 15? topics dealt directly with IVHS topics.

In parallel, a national group known as Project 2020 was also engaged in broadly similar activities. Composed of key highway transportation organizations such as the American Association of State Highway and Transportation Officials (AASHTO) and the Highway Users Federation for Safety and Mobility (HUFSA), it would sponsor many activities. One would lead to a June 1988 conference organized under their sponsorship by the Transportation Research Board (TRB). The conference topic would broadly discuss the opportunities presented by advanced electronics highway technology and systems.

In March, 1988, this ad hoc group met in a meeting in Berkeley, California to further develop a national agenda and also search for a consensus on how to establish a permanent organizational structure. While the meeting did not achieve the latter objective, it did serve to further consolidate the sense of national need and commitment to further develop this advanced technology program.

## **Mobility 2000**

Following the Berkeley meeting, Lyle Saxton of the FHWA wrote a letter to the principals of this core group, suggesting an interim ad hoc organization and offering to assist in staffing this activity until a more permanent organization was established. This offer was positively received and a meeting was scheduled for June 21, 1988 at the National Academy of Sciences in Washington DC. Nineteen individuals from government, industry and university attended in what became a major step in the evolving IVHS program. By consensus, it was decided to move forward with national planning using this ad hoc management and coordination structure and to name it Mobility 2000.

The next two days was a TRB conference sponsored by the Transportation Alliance Group and others which brought approximately 250 invited participants together to "Look Ahead To 2020".<sup>4</sup> The previous decisions of the Mobility 2000 group were informally presented and discussed during the conference which further served to give impetus and focus to those with this national interest.

With its national emergence, Mobility 2000 immediately started planning for a nation workshop. Several of the core members volunteered their services and firm plans were laid for a 3 day meeting in San Antonio, Texas in February, 1989. At this time, two individuals stepped forward and took on the heavy burden of actually finding a location and providing all the mailing, registration, program and logistical support which is essential for a successful national meeting. Dr. William Harris and Sadler Bridges of the Texas Transportation Institute volunteered both themselves and TTI to this purpose. Their combined support leading to and during the workshop were invaluable. But perhaps even more was their preparation of a workshop record which subsequently received broad national distribution and attention.

But again, several national supporting events were occurring. During the Fall of 1988, two smaller two day meetings of invited participants met to consider one of the dominant areas of interest--- that of Advanced Driver Information Systems. Substantial national publicity for IVHS also resulted from a press event in held in Ann Arbor and organized by UMTTRI and the University of Michigan. Through the efforts of two early leaders, Dr. Kan Chen and Robert Ervin, several IVHS type systems were displayed and demonstrated giving credence to the substance of this new IVHS program. It's also noteworthy that the name Intelligent Vehicle Highway Systems was originally used by Ervin and Chen.

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4 A Look Ahead: Year 2020, Transportation Research Board Special Report #220

The first Mobility 2000 National Workshop was attended by 57 invitees. Held in San Antonio, Texas on February 15-17, it became the first major national event to bring together key decision makers and the core group of those planning an IVHS program. The workshop was cast around five breakout groups: ATMS, ADIS AVCS, CV, and National Organization and Program Issues.<sup>5</sup> In setting the objectives of the workshop, the Moderator, Lyle Saxton, summarized the goal as "getting down to specifics" including:

- describing a vision of what that system is going to look like and what it is going to do for this nation,
- describing the most promising plan of evolutionary stages that should be sought to get there,
- putting special emphasis on identifying specifics of programs for the next five years.

It's worth noting that by the time of this workshop, the name Intelligent Vehicle Highway Systems had been embraced by this group and its content had been grouped into the four broad areas of Advanced Traffic Management Systems (ATMS), Advanced Driver Information Systems (ADIS) Commercial Vehicle Operations (CVO) and Advanced Vehicle Control Systems (AVCS). This program grouping had taken form in planning for the workshop during the Fall of 1988 and was used as the basis for breakout groups during the workshop. (Later, ADIS would be broadened to Advanced Traveler Information Systems (ATIS) and a fifth grouping for Advanced Public Transportation Systems (APTS) would be added recognizing this important area.

A highlight of the first workshop was the attendance of James Pitz, then the Director of the Michigan DOT and also that year's President of AASHTD. Pitz had become a strong champion of the program both in his state and nationally through his presidency of AASHTO. The Workshop had been structured to provide for three speakers to give their "Evaluation of the Workshop" at the final session. Pitz was the lead off speaker and strongly supported the IVHS program and encouraged Mobility 2000's continued national efforts to establish a firmer understanding of the program.

With the first workshop a national success, the leaders of Mobility 2000 scheduled a late March meeting in Cambridge, Massachusetts to be hosted by Joseph Sussman of MIT who was also one of the early activists in Mobility 2000. The purpose of the meeting was to review the results and consider the next steps for further developing support for a national program. It was soon agreed that a second national workshop should be organized to further develop the program's scope, goals and benefits. Also, each major meeting was very effective in bringing in new national participants and expanding the base of support. Planning and supporting activities for this next meeting was begun in earnest in late Summer.

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<sup>5</sup> Proceedings of a Workshop on Intelligent Vehicle Highway Systems by Mobility 2000, Edited by Harris and Bridges, Texas University, February 1989

A cornerstone of this effort was to establish five committees which would work through the Fall and early winter to develop a working paper with substantive program content prior to the workshop. The committees were the now classical four system areas plus a new one on Operational Benefits. Already a firm philosophy of IVHS as a national partnership had been established and co- chairs were selected for each committee with one from the Federal government and the other from a non-federal organization. The chairs of these committees and their members met many times and a more detailed consensus of the IVHS program rapidly emerged as they focused on their individual working papers.

In retrospect, one of the major legacies of Mobility 2000 is this foundation of consensus vision which has lead IVHS program development for the intervening years up to the present. Indeed, even the IVHS AMERICA Strategic Plan, which is the most substantive national document todate, dramatically reflects the definitions, scope and milestones developed in these meetings during 1989.

While these workshop planning activities were underway, two other noteworthy events were also focusing positive attention on IVHS. On June 7, the House Subcommittee on Transportation, Aviation and Materials of the Committee on Science, Space and Technology held a one day hearing on Advanced Vehicle- Highway Technology and Human Factors Research. This hearing served to continue to establish national program credibility and, in this case, it nourished a developing Congressional interest in the program.

The second event occurred at the Highway Users Federation for Safety and Mobility Annual Meeting in Washington DC in November, 1989. At this meeting HUFSAAM proposed that they and the US DOT join as partners in sponsoring a National Leadership Conference on IVHS. The objective was to pull together 100 of the top leaders in industry and government to discuss the potential of IVHS. General Motors had been instrumental in making this proposal through HUFSAAM and later assisted in the financing of the conference. In a subsequent informal, executive level planning meeting between HUFSAAM and the DOT, it was proposed that the primary focus of the conference should be the establishment of a permanent national IVHS organization to follow on the successful path charted by the ad hoc Mobility 2000. Further, that the major features of this proposed national organization should be prepared before the conference so it could be presented to the attendees of the planned Leadership Conference and be the primary focus of their discussions.

Meanwhile, planning and supporting committee work for the Second National Mobility 2000 Workshop was very active. Bill Harris and Sadler Bridges of had once again volunteered to organize the workshop and Dallas, Texas was selected as the site. The workshop was held on March 19-21, 1990 and was attended by over 200 listed participants. The working groups had each successfully prepared a detailed working paper which included sections on vision, objectives, milestones and benefits.<sup>6</sup>

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<sup>6</sup> Proceedings of a National Workshop on IVHS Sponsored by Mobility 2000, Edited by Harris and Bridges, Texas A&M University March 1990

The workshop was then organized around the five crosscutting groups:

- Program Milestones
- Research and Development Needs
- Operational Tests
- Program Investment Requirements
- Organizing for IVHS

The Dallas workshop served to cement the vision and major program features which had been evolving through the many prior meetings and national activities. Thus, there was a strong consensus that Mobility 2000 7 had established a sound basis justifying the undertaking of a major national IVHS effort. It's an interesting aside that much discussion and emotional energy was devoted during the workshop to developing an estimate of program cost -- especially deployment costs. Richard Braun had been assigned this working group and labored late with his group to develop meaningful estimates. The debate centered on whether to publish the estimates or whether they might seem so high that they scared off support for the program. In the end, the majority view was to openly display the estimates as it was strongly felt that the cost-benefits were substantial and certainly supported the estimated investment.

Following this second Mobility 2000 National Workshop a flurry of activity occurred to produce a written record of the results and recommendations in time for the May National Leadership Conference. With considerable hard work from the principals involved in the workshop, and especially TTI, an excellent executive summary was prepared by late April.' This summary was updated and printed as a glossy 20 page document entitled Mobility 2000 Presents Intelligent Vehicle Highway Systems. This document was widely distributed and was one of the most effective succinct descriptions of IVHS that has been prepared. It's page on Action Items described eleven items which have become the main elements of the national program. Excerpts include: establish a strategic plan, determine appropriate architectures, create a national organizational structure, provide mechanisms for international cooperation, promote technical standards, etc.

In May 3-5, 1990, the National Leadership Conference was held with Secretary Sam Skinner and Alan Smith of General Motors as the co-chairmen. Later that year IVHS AMERICA would be formally established and Congress would substantially increase funding for federal IVHS programs. The US DOT would establish a formal IVHS program office and recognize IVHS AMERICA as a utilized federal advisory committee. Clearly, a national IVHS program was in place.

In retrospect, the work of the many dedicated individuals, and especially the core group who had started in the mid 80's had succeeded in developing a vision and description of IVHS which continues today. In the process they brought national attention to this area through their efforts in Mobility

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7 Mobility 2000 Presents Intelligent Vehicles and Highway Systems: 1990 Summary, Harris/Bridges, Texas A&M University, March 1990

2000. They had, in fact, succeeded in being the catalyst and agent of establishing a robust national IVHS program.

## **Conclusions and Observations**

Many of the earlier programs undertaken in the 1960's never made it to implementation. But it would be a serious error to discount the positive results and role of the earlier programs in leading to the successful establishment of the current program. products from this earlier program. In fact, there were many successful One very tangible product was the UTCS and the national emphasis and focus it placed on modern computer traffic signal control. The FHWA became a leader in developing, encouraging and providing federal funding assistance to the installation of these modern systems.

A second result was the international attention which this program fostered -- especially in Japan. For example, around 1972 the FHWA Research offices hosted a major delegation from Japan and discussed its research efforts with special emphasis on ERGS. Mr. Yamoto of Sumitomo Electric and Mr. Fujii now with JSK were members of this delegation as was this author. These discussions contributed to Japan's important efforts from 1973 to 1978 to develop and evaluate their Comprehensive Automobile Communication System (CACS). CACS was in turn the precursor of Japan's RACS and AMTICS efforts. Similar activities were undertaken in Europe during the 1970's especially in the UK and West Germany. For example, the Federal Republic of Germany developed and field evaluated the AL1 which was a route guidance system very similar to ERGS and CACS.

A third contribution from the earlier BPR program was the context of potential benefits which it brought to national thinking regarding future traffic operations. Embedded in the program results was the recognition that modern electronic communication and control systems do indeed hold tremendous promise for future highway operations and would someday achieve this potential. In this respect, the program provided a level of expectation and opportunity waiting in the wings for the national need. This awareness became especially important in discussions associated with "beyond the Interstate construction era" and "how to deal with growing urban congestion".

But even though the earlier program contributed to the establishment of IVHS, the question still remains. Given the substantive program in the 1960's. what happened and why weren't they brought to successful completion and deployed? In short, why aren't we operationally using these systems today in our highway operations?

Briefly, there are at least six principal reasons supporting today's strong IVHS program which did not exist earlier. First, there is a very serious congestion problem today that is recognized as affecting mobility and commerce. Further, this problem is not stabilized but is continuing to grow in severity with no adequate traditional solutions available. In the 1960 s the beginnings of this problem were recognized but the problem was not particularly serious and there was not the national support to get in front of this issue.

Second, our society has become information, communications and control technology based. We accept and even demand technology such as cellular phones, cordless phones, personal computers, portable mini t v ' s etc. which have conditioned us to the capability and utility of state of the art electronics based technology. In the 1960's these type of personal and business devices did not exist and much of the technology envisioned for highway implementation was looked at by budget and program decisionmakers as Buck Rogers and not realistic.

Third, the Interstate Highway construction era is over and no major new construction is anticipated. program philosophy has shifted In the last decade our mindset and highway from that of system expansion through new construction to that of efficient operation of the existing physical plant. This emphasis on operation has raised to a much higher priority those technologies and systems such as IVHS which hold promise for benefits in efficiency and safety. By contrast in the 1960's, while good operations was an acknowledged desirable feature, it was generally not seen as a particularly important program priority. The new ISTEA of 1991 is a dramatic legislative statement embracing this new emphasis on operations.

Fourth, today's enabling technology state of the art, especially in electronics and semiconductors, has reached the stage where very powerful and highly sophisticated devices are available for processing, storage, and display functions. Further, these devices allow for the small packaging and affordable cost which is an essential market requirement. The 60's technology did not include microprocessors, integrated circuits -- especially the Very Large Scale Integration (VLSI) of today, CD rom, flat screen displays, etc. The list seems almost endless. Thus the resulting systems were much, much less powerful (intelligent), packaging was much more bulky and the system architecture favored centralized systems over distributed (to use large mainframe computers). On board vehicle systems were much less robust in the services and features provided to the motorist.

Fifth, today's program evolved from a newly found partnership between industry, university and state, local and federal government. This partnership early recognized the different roles and objectives of each, but in doing so it built in a the necessary features which have cemented this strong partnership foundation. Out of this partnership, key national figures have become program "champions". In contrast, the earlier program in BPR was a standard federally run research program. The government was both setting design goals and developing prototype designs. A lack of true partnership with industry and other government almost guaranteed no buy-in or commitment to take these systems to production and operation.

And sixth, the present IVHS program, while having a major research element, has deliberately and wisely focused on a balanced program that also emphasizes operational testing and early implementation of results. Further, the various agencies have stepped forward with a strong commitment to the deployment of state of the art systems which have demonstrated operational benefits. while the earlier programs certainly intended eventual implementation, they were research activities which did not provide a sense of operational application in the near future.

These six primary characteristics of the mid and late 1980's provided an environment very supportive of the research and application of advanced electronic highway systems and what has become the IVHS program. But perhaps most of all, in the mid 80's a core group of individuals bought into the national need and value of IVHS. Coming from divergent interests and backgrounds they banded together and shaped a common vision and consensus which is now embodied in the present IVHS program.