THE SMART HIGHWAY PROJECT:

SMART HIGHWAYS
SMART VEHICLES
SMART ENGINEERING

TRANSPORTATION BEYOND 2000:
Technologies Needed for Engineering Design

Langley Advanced Transportation Workshop

September 26-28, 1995

RAY D. PETHTEL

Interim Director, Center for Transportation Research, and

University Transportation Fellow

CENTER FOR TRANSPORTATION RESEARCH

- Interdisciplinary
- Multidisciplinary
- Decentralized

  Resources:

  - 14 Core Staff Positions
  - 24 Students (50% MS, 50% Ph.D.)
  - 14 Cooperating Faculty
  - 6 Cooperating Labs
  - $9 Million Total Value of Research Awarded

DESIGNATIONS AND RELATIONSHIPS

- ITS Research Center of Excellence (FHWA)
- Mid-Atlantic University Transportation Center
- Associate Participant, National Automated Highway System Consortium (NAHSC)
- Capital Beltway Safety Advisory Committee
- Participant, Virginia Transportation Research Council (VDOT)

SURFACE TRANSPORTATION FACILITIES SERVE A VARIETY OF PURPOSES AND ARE EXTREMELY IMPORTANT TO MODERN LIFESTYLE

- Provide for the efficient movement of people and goods necessary to support a modern economy and mobile lifestyle
- Serve adjacent land uses
- Enhance personal mobility
- Give access to services and support economic growth
- Permit flexibility in the selection and maintenance of quality of life choices

THE "SMART HIGHWAY" WILL BE A TEST BED AND TEST TRACK FOR INTELLIGENT TRANSPORTATION SYSTEMS (ITS) RESEARCH

- The road is a critical part of the highway network in the region and is expected to carry 20,000 vehicles each day by the year 2015.
- This is the only ITS research facility being designed and built from the ground up to accommodate evolving technologies in each subsequent stage of construction. Will serve as a full scale test bed and test track for AHS research in cooperation with the NAHSC.
- The potential research market associated with the Smart Highway could be up to $100 million over the next 20 years.
- Environmental studies are completed, and preliminary design is underway. Final Public Hearing is October 18, 1995 in Blacksburg.

THE NATIONAL AUTOMATED HIGHWAY SYSTEM CONSORTIUM (NAHSC) WILL DEFINE FUTURE HIGHWAY SYSTEMS

- The NAHSC is a federally established entity which is intended to define the nature of future highway systems and then develop and demonstrate one or more prototypes of a fully automated highway.
- The NAHSC budget is $150 million for research over the next 7 years.
- This is a public/private partnership involving top national industries including General Motors, Delco Electronics, Lockheed Martin, Hughes Aircraft, Bechtel, Parsons Brinckerhoff. Also includes Carnegie-Mellon, Caltrans, UC Berkeley PATH, and USDOT.
- Virginia Tech was selected in the first group of Associate Participants and will serve in a variety of research areas including evaluation.

NATURE OF SUBSTANTIVE RESEARCH

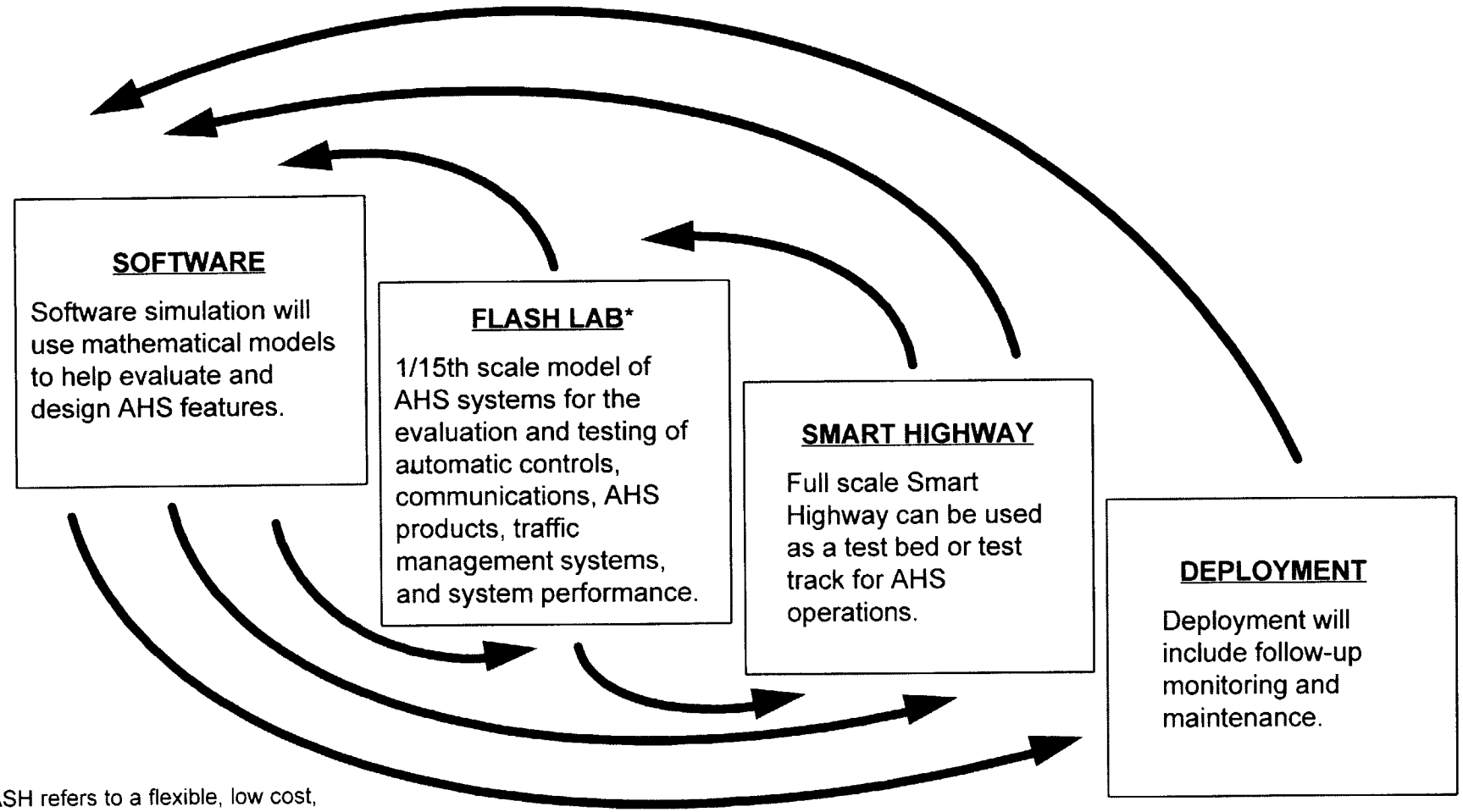
Short Term:

- Automated vehicle identification, as on Dulles Toll Road
- High speed weigh in motion, as at I-81 Troutville weigh station
- Road surface sensing for freezing and pavement condition

Longer Term:

- Vehicle to roadside communications
- Vehicle control such as lane following, lateral control, automated steering, and headway distance
- Collision avoidance
- Automatic trip routing
- Fully automated highway systems

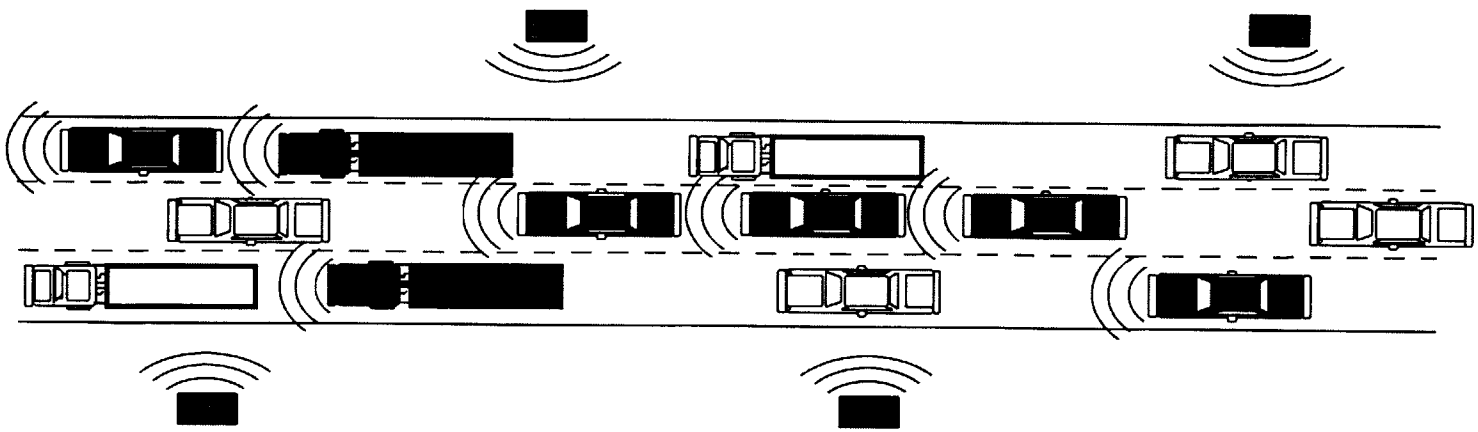
VIRGINIA TECH'S EVALUATION APPROACH



*FLASH refers to a flexible, low cost, automated, scaled highway system. The system can be portable.

COOPERATIVE INFRASTRUCTURE MANAGED SYSTEM

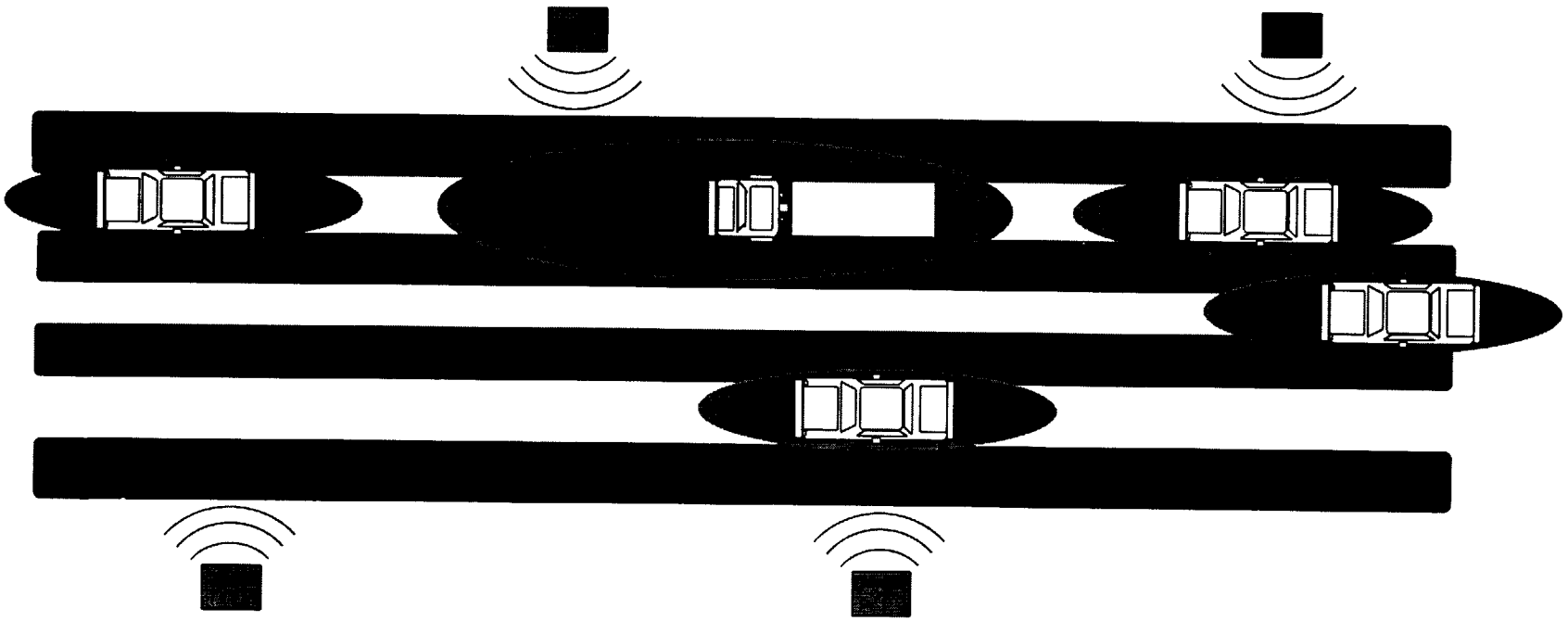
- Ultra-wideband communication in roadway beacons
- Obstacle detection and other sensors in vehicles
- Vehicle/infrastructure cooperation
- Global management



COOPERATIVE INFRASTRUCTURE MANAGED SYSTEM CHARACTERISTICS

- Infrastructure impact is low to medium
- Instrumentation distribution is mixed between highway and vehicles
- Uses global strategy to synchronize traffic
- Permits active infrastructure control
- Gives access to conventional and automated vehicles
- Operating speed is variable by conditions, up to 100's possible
- Includes all vehicle classes
- Uses rubber tire vehicles
- Power is on-board vehicles

CONTROLLER FIELD ILLUSTRATION



ULTRA-WIDEBAND TECHNOLOGY FEATURES

- Low cost device due to solid state electronics
- Highly accurate radar ranging (better than centimeter accuracies possible)
- Good range (200 feet currently, 2 miles or better expected)
- Multiple communications possible
- Interference not a problem
- Can penetrate solids and go around corners

OTHER ITS APPLICATIONS OF ULTRA-WIDEBAND

- Automatic vehicle identification
- Advanced traveler information systems (roadside to vehicle information)
- Transportation planning
- Advanced traffic management systems (probe vehicle tracking, link travel time)
- Parking management (space sensor)
- Collision avoidance (proximity detector, blind spot detector, headway sensor)
- Automated highway system (cooperative ranging, vehicle to vehicle communications, vehicle to roadside communications

THE PRODUCT OF THIS TECHNOLOGY BEYOND 2000

- Foot off the gas
- Hands off the wheel
- Brain off the driving task

To produce a safe, modern, efficient transportation system