

FINAL REPORT

For KTC Work Order 2006-06-21-01
KTC Prime Contract: SB1341-05-Z-0023
KTC Task Order: 66439

First Joint Military/Civilian Conference on Intelligent Vehicle Technology Transfer 2-3 November 2005

Mr. Maris Juberts, Project Manager
Intelligent Systems Division, National Institute of Standards & Technology
Bldg. 220, Room B124, Gaithersburg, Maryland 20899
Phone: 301-975-3422; Fax: 301-990-9688
juberts@cme.nist.gov

Supported By:
Office of the Secretary of Defense Joint Robotics Program
Army Tank Automotive Research, Development, and Engineering Center
DOT Intelligent Transportation System Joint Program Office

Submitted By:
Dr. Robert Finkelstein, President
Robotic Technology Inc.
11424 Palatine Drive, Potomac, Maryland 20854-1451
Phone: (301)-983-4194; Fax: (301)-983-3921
RobertFinkelstein@compuserve.com

18 July 2006

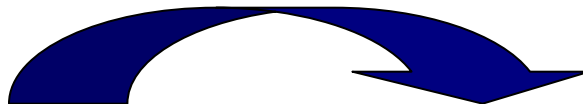
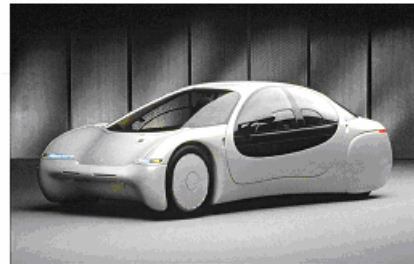


TABLE OF CONTENTS

SECTION	PAGE
PURPOSE	2
BACKGROUND	2
Motivation	2
DOD Technology	3
DOD intelligent Vehicle Programs	4
DOD Robotics Technology Base	5
Example DOD Intelligent Vehicles	5
DOD Enabling Intelligent Vehicle Priorities	7
DOT Vision for Intelligent Vehicles	7
DOT Motivation	7
Driver Assistance	8
An Autonomy Scenario	8
ITS Progress and Example Commercialized Technology	8
Intelligent Vehicle Technology Transfer	9
CONFERENCE ANNOUNCEMENT	10
Agenda: 2 November 05	10
Agenda: 3 November 05	11
PRESENTATIONS	12
PARTICIPANTS	12
STEERING COMMITTEE	21
BREAKOUT SESSIONS	23
Technology Transfer Framework	24
Technology Transfer Issues	25
Technology Transfer Benefits	27
Value of the Breakout Sessions	29

PURPOSE

The **First Joint Military/Civilian Conference on Intelligent Vehicle Technology Transfer** was held on 2-3 November 2005 at the U.S. Army Tank Automotive Research, Development, and Engineering Center (TARDEC). The **purpose** of the conference was to continue the progress toward establishing an intelligent vehicle technology transfer (IVTT) program, which was initiated at Workshop held at the National Institute of Standards and Technology on 26 July 2005. The Conference provided a **forum for disseminating information** to the attendees (civilian and military, and from government, industry, and academia) concerning the **state of intelligent vehicle technology** and the plans for the IVTT. Ideas were solicited from the participants concerning technology transfer, along with discussions of **key issues**. The Conference was also a venue for developing a **core constituency** for the IVTT, including the formation of a **Steering Committee**.

The IVTT program is initially intended to serve the **Department of Defense** (DOD) and its stakeholders (government agencies, laboratories, industry, and academia) and the **Department of Transportation** (DOT) and its stakeholders (government agencies, laboratories, industry, and academia). Additional government agencies (and associated stakeholders) may be served by the intelligent vehicle technology transfer process, including the **Department of Energy** (DOE) and the **National Aeronautics and Space Administration** (NASA). The **National Institute of Standards and Technology** (NIST), an agency of the **Department of Commerce**, will serve as a facilitator for the IVTT.

We apologize that, because of administrative issues beyond our control, this **Final Report** (and the **Proceedings CD** in which it is embedded) is **being issued later than originally planned**. However, the Intelligent Vehicle Technology Transfer process is again **on schedule** and we look forward to working with all of you in furtherance of this transformational technology.

BACKGROUND

This section provides the **rationale** for the IVTT and an overview of the relevant **technology and programs** in DOD and DOT.

Motivation

The DOD and DOT are both supporting the development of **intelligent vehicles**. The DOD is deploying a variety of autonomous intelligent vehicles (robots) to **reduce human casualties** on the battlefield and increase the global combat **efficiency and effectiveness** of the U.S. military against conventional and unconventional forces. Similarly, the DOT supports intelligent vehicle technology to reduce human casualties on the nation's highways and increase the efficiency and effectiveness of the U.S. transportation system.

The DOD's rapid progress in intelligent vehicle technology can directly **benefit the commercial development** of intelligent cars, trucks, and buses, reducing time and expense for the automotive industry. On the other hand, technology transferred from DOT and commercial sector to DOD

and DOD contractors will **reduce the cost and increase the availability** of commercial-off-the-shelf (COTS) intelligent vehicle systems and components for military services.

Thus **benefit of mutual technology transfer**, between the military and commercial sectors, is exemplified by computer technology. Expensive military computer technology became faster, better, cheaper – and ubiquitous – after commercialization. A formal process for sharing and leveraging intelligent vehicle technology between DOD (and its stakeholders) and DOT (and its stakeholders), and other government agencies, will facilitate advent of intelligent vehicles. Intelligent vehicle technology is a quickly **emerging disruptive (or transformative) technology** offering enormous potential benefits for the military and civil sectors alike.

In summary, societal impacts and benefits from the IVTT are expected to be significant, including **freedom** of movement for those other wise unable to drive, such as the incapacitated elderly, the disabled, and juveniles. The “soccer moms” will also be freed from being perpetual chauffeurs for their young children. Commuters will be free to rest or work during their commutes, and vehicles can be sent on errands (e.g., pick up groceries ordered online) on their own. **Freedom, convenience, and, most importantly, safety**, will have major impacts on the quality of life. There are also implications, yet to be explored in detail, on government services, such as law enforcement, as well as impacts on the environment (e.g., pollution, urban planning, and suburban sprawl). The IVTT will also have a major role in the **public’s understanding and ultimate acceptance of intelligent vehicle technology**.

DOD Technology

Advanced intelligent vehicle technology which **DOD can transfer to DOT** includes: **control systems, sensor systems, mobility systems, and interface systems**.

Intelligent vehicle control systems encompass the core technology which provides the intelligence (and ultimately, cognition) for the intelligent vehicles. In particular, the **control system architecture** provides the framework for the vehicle’s “intelligence.” A pragmatic **definition of intelligence**: “an *intelligent system* is a system with the ability to act *appropriately* (or make an appropriate choice or decision) in an uncertain environment.” An *appropriate* action (or choice) is that which maximizes the probability of successfully achieving the *mission goals* (or the *purpose* of the system). Intelligence need not be at the *human* level; all organisms, for example, manifest sufficient intelligence for their function in life (i.e., to survive long enough to reproduce). **Appropriate intelligence for a vehicle** is ability of vehicle to perform as a skilled human driver would under a variety of conditions. The desired level of vehicle intelligence depends on the user’s requirements (whether military or civilian), and the technical, operational, and economical feasibility of achieving the desired level of intelligence.

Intelligent vehicle control systems encompass various kinds of hardware and software, including: control system architecture; sensory perception and situation awareness; software; databases and world modeling; communications internal and external to the vehicle; vehicle mobility; and the architecture of the computer hardware. The **resulting behavior** of the intelligent vehicle includes: situation awareness, collision detection and avoidance, route planning, task decomposition, lane-following, and sign and obstacle detection.

Major elements of a robotic vehicle's **sensor system** include **internal and external sensors**, where sophisticated processing is needed to extract information from the raw data emanating from the sensors, which can then be used by the intelligent vehicle. The architecture (or connectivity arrangement) of the sensor system also contributes (along with sensor processors and control system architecture) to **sensory perception**, which is the ability to fully understand the object that is sensed in the context of the situation and environment. The number and type of sensors needed by intelligent vehicle depends on its size, mission, and environment.

Internal sensors include those used for: guidance, navigation, and attitude (such as global positioning system, mechanical or laser gyroscope, and other inertial and dead reckoning systems, accelerometer, pitch and roll sensors, wheel encoders, steering position sensors, compass, odometer, gravitometer, etc.). **Status sensors** include those to measure: fuel, temperature, engine speed, ground speed, equipment functionality, etc.

External sensors are manifold, and include those used for: passive and active optical imaging (video, low light level, forward looking infrared, laser radar [ladar], structured light, stereo vision); acoustic detection; proximity sensors (such as ultrasonic acoustic ranging [sonar], laser ranging, microwave radar ranging, Doppler radar, limit switches, bumpers, and whiskers); touch sensors; force sensors; electric field sensors; meteorological sensors (sensing temperature, precipitation, humidity, wind, atmospheric pressure); smell and taste sensors (such as chemical, biological, and radiological sensors)

The **mobility system** for intelligent vehicles may be based on conventional vehicle platform design (chassis, engine, transmission, etc.), or they may incorporate “**intelligent mobility**” concepts, where the **inherent design** (intrinsic, physical mobility assets) of the vehicle allows it to move well (especially in an unstructured, off-road environment) without the need for continuous active participation of the intelligent control system.

The **interface** between the intelligent vehicle and the human consists of various kinds of **controls and displays** (e.g., touch screens, voice interaction, joy sticks, and virtual reality). Part of the interface is also the attention which must be paid to the vehicle by various people over its lifetime, such as for testing, maintenance, and support. People associated with the robot must be trained in its **operation, maintenance, and repair**. The **communications system** (command, control, and data links, antennas, transmitters, receivers, power supplies, computers, signal processing, etc.) is also an interface system

The ideal for the intelligent vehicle architecture is for it to be **open, interoperable, and common**. An **open architecture** allows different modules to be inserted easily into the system (as in home stereo systems). An **interoperable architecture** allows each vehicle or control center to work with different vehicles platforms, payloads, and communications networks. A **common architecture** allows each vehicle or control center to use the same hardware and software as other vehicles or control centers.

DOD Intelligent Vehicle Programs

There are many intelligent vehicle development programs within DOD, scattered about a number of services and agencies. In particular, DOD is supporting development of a number of intelligent ground vehicles through the **Joint Robotics Program** (JRP), including the massive **Future Combat System** (FCS) Program and programs supported by the Defense Advanced Research Projects Agency (DARPA), as well as other agencies. DOD programs are developing and fielding first-generation unmanned ground vehicles with current technologies while pursuing advanced technologies critical to autonomous vehicles. Evolutionary improvement to first generation vehicles will be followed by second generation intelligent, autonomous vehicles. The JRP is currently developing **22 distinct intelligent vehicle systems** across a variety of weight classes, from less than 8 pounds (micro) to more than 30,000 pounds (large). The JRP Coordinator supports the development of intelligent vehicle technology and systems in a **multiplicity of DOD agencies**, including:

- Joint Architecture for Unmanned Systems (JAUS)
- US Army Product Manager Force Protection Systems
- US Army Aviation & Missile Research, Development & Engineering Center
- Robotic Systems Joint Project Office (Army/Marine Corps)
- Agile Combat Support (USAF AAC/YBC)
- Air Force Research Lab (Robotics Group)
- Space & Naval Warfare (SPAWAR) Systems Center (Navy)
- Program Management Office for EOD Robotics (Navy)
- US Army Tank-automotive & Armaments Command (TACOM) Research, Development & Engineering Center (TARDEC)

DOD Robotics Technology Base

The DOD **robotics technology base** is distributed among many agencies and institutions, including several outside DOD. The technology base consists of:

- DARPA
- Army Research Lab (ARL)
- Special Operations Command (SOCOM)
- Military R&D Centers
- Academia
- Product Manager for Robotic & Unmanned Sensors (PM-RUS);
- National Center for Defense Robotics (NCDR)
- National Unmanned Systems Experimental Environment (NUSE2)
- Advanced Concept Technology Demonstrations (ACTD)
- Office of Naval Research (ONR)
- Army RDECOM Simulation Training Technology Center (STTC)

Example DOD Intelligent Vehicles

The **Robotic Systems Joint Project Office** (which jointly serves the Army and Marine Corps) is supporting the development of:

- Common Robotic System (CRS)/Panther
- Robotic Combat Support System
- Tactical Unmanned Ground Vehicle (TUGV)
- Future Combat System Unmanned Ground Vehicles

The **U.S. Army** (as might be expected) has been active in the development of robotic ground vehicles. The **Army Research Laboratory** (ARL), for example, has long supported the development of autonomous ground vehicles, including the DEMO series of field experiments, represented most recently by DEMO III and the Experimental Unmanned Ground Vehicle (XUV). ARL is also active in developing semi-autonomous robotics for FCS and the Robotic Collaborative Technology Alliance (CTA). The US **Army Tank Automotive Research, Development and Engineering Center** (TARDEC) has been developing intelligent mobility, the Crew Integration and Automation Testbed (CAT) Advanced Technology Demonstration (ATD), the Armed Reconnaissance Vehicle Robotic Technologies (ART) Army Technology Objective (ATO), the Robotic Follower (RF) Advanced Technology Demonstration (ATD), and the Human Robot Interface (HRI) ATO. The **Army Materiel Command** (AMCOM) Research, Development & Engineering Center has been developing the Joint Architecture for Unmanned Systems (JAUS), the Cooperative Unmanned Ground Attack Robot (COUGAR), and the Collaborative Robotics Operations Initiative.

The **Air Force Research Laboratory** (Robotics Group) focuses on unmanned ground vehicles (UGV) instead of the unmanned air vehicles (UAV) that are the focus of most Air Force unmanned vehicle programs:

- Robotics for Agile Combat Support (RACS)
- Advanced Robotic Systems (ARS)
- Next Generation EOD Remote Controlled Vehicle (NGEODRCV)
- Remote Detection, Challenge, and Response System (REDCAR)

In addition, the **Air Armament Center** Agile Combat Support (AAC/YBC) Program Office has been developing the All-purpose Remote Transport System (ARTS).

The **U.S. Navy**, while most active in the development unmanned air and sea platforms, has also been with in robotic ground vehicles, especially for Explosive Ordnance Disposal (EOD) missions. The **Program Management Office for EOD** has been developing the Remote Ordnance Neutralization System (RONS) and the Explosive Ordnance Device, Man-Transportable Robotic System (EOD MTRS). The Navy's **Space and Naval Warfare Systems Center** (SPAWAR) has long been interested in robotic systems, most recently developing the Mobile Robot Knowledge Base (MRKB), the Robotic Systems Pool (RSP), and a novel UGV.

The **Defense Advanced Research Projects Agency** (DARPA) has supported robotics-related research and development for decades, most recently with the Perception for Off-Road Robotics (PerceptOR), the Unmanned Ground Combat Vehicle (UGCV), and the Learning Applied to Ground Robots (LAGR) program.

The **Product Manager for Force Protection Systems** has been developing the Mobile Detection Assessment Response System (MDARS), which has external and internal versions which, within known environments, will become the military's first fully-autonomous operational robotic platform.

The **Product Manager for Robotic and Unmanned Sensors** is developing new tactical unmanned vehicle payloads, FCS unmanned systems sensors, Remote Battlefield Sensor System (REMBASS) II, and the Ground Surveillance Radar (GSR).

The DOD has manifold **sources of emerging and transformational technology** for intelligent vehicles, much of which would be valuable for commercial automotive applications.

DOD Enabling Intelligent Vehicle Technology Priorities

The DOD has the goal of achieving **fully autonomous vehicles**, with situation awareness and adaptive behavior, by 2020. In furtherance of this goal, DOD has interim **enabling intelligent vehicle technology priorities**. These include establishing a **common architecture** that is **open and modular** with **standardized interfaces** and which progresses toward **commercial standards**. Another priority is to develop, in the near-term, **semi-autonomous mobility** with obstacle detection and avoidance, tactical behaviors, and suitable man-machine interfaces. This will be followed by integrating mission payloads, including manipulators, sensors, and weapons, and achieving an **appreciable level of intelligent autonomy by 2010**, and then vehicle intelligence sufficient for **complete autonomy by 2020**. When that is accomplished, human intervention for missions will approach zero.

DOT Vision for Intelligent Vehicles

The Department of Transportation envisions a system involving roads, vehicles, and drivers, where drivers operate in a **significantly safer environment**, enjoy greater mobility and efficiency as a result of vehicle-based autonomous and infrastructure-cooperative **driving assistance** features. However, unlike DOD, **there is no current DOT vision for autonomous vehicles**.

DOT Motivation

A primary DOT motivation for supporting intelligent vehicle technology is the same as that of DOD, to save lives, because the technology can significantly **reduce motor vehicle accidents** (which, incidentally, are a **major cause of death and injury in the military as well**). Each year more than **41,000 Americans die** as a result of about **6 million crashes**, the equivalent of 115 crashes each day, or **one every 13 minutes**. The personal and economic impact of highway injuries is horrendous. More than **3.2 million Americans** are injured per year, with crash survivors often sustaining multiple injuries and requiring long hospitalizations, and costing the U.S. economy more than **\$230 billion** a year. The consequences of automotive accidents consume a greater share of national health care costs than any other cause of illness or injury. This toll on humanity is multiplied many times in other nations around the globe. New

technology offers potential safety solutions but poses new problems (e.g., some in-vehicle technology may become a dangerous distraction to drivers, at least while it is a novelty).

The National Highway Traffic Safety Administration (NHTSA) estimates that driver inattention, from all sources, causes 20 to 30 percent of the 6.3 million accidents per year. **Driver error**, not vehicle failure, remains the leading cause of crashes, cited in more than 90 percent of police crash reports. The DOT intelligent vehicle mission is to reduce the number and severity of crashes through **driver assistance systems** which assume *partial control* of vehicles to avoid collisions. The focus on *preventing* crashes, by helping drivers avoid hazardous mistakes, is a significant new direction for DOT safety programs, which previously had a primary focus on crash *mitigation* (i.e., alleviating the severity of crash-related injury to persons and property).

Driver Assistance

Current DOT intelligent vehicle vision does not encompass fully-autonomous vehicles, only **driver assistance systems**. Nevertheless, these systems can warn drivers of danger or, in more advanced versions, intervene to prevent or mitigate accidents (e.g., intermittent automated braking or steering), all of which can save many lives. But the technology transfer between DOD and DOT should include consideration of the technical, economical, and social issues concerning **ultimate autonomy for cars, trucks, and buses**, just as the military intends for combat vehicles.

An Autonomy Scenario

As an **example autonomous car scenario**, consider the commuter entering the car at home and telling it where he wants to go. It takes him to his destination (while he reads, talks on the phone, works on the computer, sleeps, or watches videos), then parks itself after dropping him off at the office. After work (or a night out), the commuter summons the vehicle with a phone call. The “built-in chauffeur” will be safer and more efficient than a human driver, benefiting millions of baby boomers who are becoming elderly and will lose driving privileges. And the disabled of all ages will gain the freedom to travel in their own cars without the debilitating dependence on others.

ITS Progress and Example Commercialized Technology

Since the 1990 initiation of the DOT’s Intelligent Transportation System (ITS) Program, there has been remarkable progress in commercializing advanced technology in vehicles and the transportation system. Some of the technology, like the **Global Positioning System** (GPS) and infrared sensors, originated with the DOD. Much of the current and near-term commercially-feasible intelligent vehicle technology did not exist at the start of ITS in 1990. GPS navigation, for example, is very popular and contributes to safety as well as convenience because lost drivers are unsafe drivers. Some cars are equipped with **automated crash notification** (“Mayday”) system which senses when airbag are deployed (as a consequence of a crash) and, with the GPS location, calls for help via satellite phone link to a control center. This especially benefits unconscious drivers in remote or non-visible locations (such as a drainage ditch). Cars are also increasingly equipped with **adaptive cruise control**, which maintains vehicle speeds consistent

with selected safe distance from vehicle in front, braking and accelerating as required. **Back-up object detection** systems prevent the driver from backing into a bicycle or a car and assist with parallel parking (and a few models are even equipped with **automated parallel parking** systems). **Crash warning and automated crash avoidance** systems sense objects and may automatically respond with brake and steering. **Automated lane tracking** senses lane markers and may automated steering, and **lane change warning** systems sense oncoming vehicles in the adjacent lane.

Additional systems being developed for drivers include driver **distraction and drowsiness detection** and mitigation systems which sense the driver's eyes, head position, or steering. **Head-up displays** project information onto the windshield to reduce driver distraction. **Haptic systems** provide the driver with warning cues by means of touch feedback. **Road-departure crash warning** systems sense movement of the vehicle across lane markers and either warn the driver or automatically correct the steering. **Rollover prevention** systems sense vehicle stability and attitude and autonomously correct with corrective steering and braking. Night vision is becoming more common, with infrared sensing to allow drivers or vehicles to detect objects at night.

Real-time information on traffic conditions, displayed on navigation maps, is available to the public on the Internet and public transit vehicles, as well as traffic control center. **Fleet management** systems for commercial trucks, buses, taxis, police and emergency vehicles, hazardous waste transporters, etc., are tracked and routed by company or government control center.

Automated bus systems are proliferating, with semi-autonomous or autonomous buses on fixed bus lanes (becoming a kind of horizontal elevator). **Intersection collision countermeasures** (for vehicles and pedestrians) monitor the intersection and provide warning of impending collisions, with sensors communicating among the infrastructure and vehicles at intersections. **Travel and service information** are available or transmitted to numerous sources (on buses and trains, home television, radio, Internet, public kiosks). **Electronic weighing and inspection** senses commercial vehicles in motion and enables electronic issuing and monitoring of permits or tracks containers throughout multi-modal shipment. **Traffic management** systems monitor current conditions and adjust lane usage, speed limits, traffic signals, and roadway ramp access based on actual traffic conditions rather than historical patterns. **Public transit** enhancements include smart cards, real-time displays of service status, and systems for dynamic ride sharing. **Automated toll collection** is becoming common, with electronic collection of tolls, transit fares, and other transportation user fees.

Intelligent Vehicle Technology Transfer

The technology transfer process must be **mutually beneficial** between DOD and DOT and their stakeholders, where DOT gains advanced technology and DOD gains affordable technology. In addition, other agencies, such as DOE and NASA (and their stakeholders), should benefit as well. To be **effective and efficient** the technology transfer process must be: established from the top down and bottom up; permanent and continuous; simple and robust; and supported mutually and beneficially for all stakeholders.

CONFERENCE ANNOUNCEMENT

We prepared an **announcement** for prospective participants. It included the **purpose** of the Conference and its **background**, along with a list of the member of the **Steering Committee** which had been formed in the previous Workshop (and which would be enlarged subsequently by additional volunteers during the Conference). The Announcement also included the **agenda** and **registration forms** (for U.S. and non-U.S. citizens, as requested by TARDEC), along with **directions** to TARDEC and information on nearby **accommodations**. There was no charge to attend the Conference, but a nominal charge for meals and refreshments.

Agenda: Wednesday 2 November 05

- 0800-0900** Continental Breakfast and Networking
- 0900-0915** Introduction to the First Intelligent Vehicle Technology Transfer Conference
Presenter: Mr. Maris Juberts, Manager, Intelligent Mobility Systems, NIST
- 0915-0930** Welcome to TARDEC and the Conference
Presenter: Dr. Richard McClelland, Director, TARDEC
- 0930-1000** Overview of the Intelligent Vehicle Technology Transfer Process
Presenter: Dr. Robert Finkelstein, President, Robotic Technology Inc.
- 1000-1030** Military Intelligent Vehicle Technology and Program Overview
Presenter: Mr. Cliff Hudson, Manager, DOD Joint Robotics Program
- 1030-1045** Break and Refreshments
- 1045-1115** Army Research on Intelligent Vehicles
Presenter: Mr. Chuck Shoemaker, Manager, ARL Robotics Program
- 1115- 1145** Civil Intelligent Vehicle Technology and Program Overview
Presenter: Mr. Michael Freitas, Managing Director, DOT ITS JPO
- 1145-1300** Lunch and Networking
- 1300-1330** Intelligent Cars and Trucks: Now and the Future
Presenter: Ms. Suzanne Murtha, Director, Vehicle Safety Systems, ITS America
- 1330-1400** International Status of Intelligent Vehicle Technology
Presenter: Mr. Richard Bishop, President, Bishop DOT Consulting
- 1400-1415** Break and Refreshments
- 1415-1445** Intelligent Vehicle Technology Transfer: An Automotive Company Perspective
Presenter: Mr. Ehsan Taqbeem, Portfolio Manager, Daimler Chrysler

- 1445-1515** The Future Market for Intelligent Vehicles
Presenter: Dr. Jeff Ostaszewski, Market Analyst, iRobot Corp.
- 1515-1545** Overview of the Army's National Automotive Center
Presenter: Mr. Anthony Camito, Associate Director, National Automotive Center
- 1545-1715** Participant Discussion: How to Make It Work
- 1800-2200** Networking Dinner (Buffet at the Gazebo, one mile from TARDEC)

Agenda: Thursday 3 November 05

- 0800-0900** Continental Breakfast and Networking
- 0900-0930** Information for the Breakout Sessions
Presenter: Dr. Robert Finkelstein, President, Robotic Technology
- 0930-1100** Breakout Sessions:
- Technology Transfer Framework: Website, Databases, Workshops, Conferences, Exhibits, Media, Publications, Topics
 - Technology Transfer Issues: Competition, Liability, Architecture, and National Security
 - Technology Transfer Benefits: Markets, Niche Markets, Opportunities for Industry, Societal Impacts
- 1100-1200** Plenary Discussion
- Breakout Sessions Summaries
 - Steering Committee
 - Roadmap for the Intelligent Vehicle Technology Transfer Process
- 1200-1300** Lunch and Networking
- 1300-1500** Optional TARDEC Facility Tour
- 1500** Adjourn

PRESENTATIONS

The presentations, which are **included in the Proceedings** (i.e., included in the CD in which this report resides), were given by prominent speakers from government (DOD, DOT, and NIST) as well as industry (e.g., defense contractors and the automotive industry) and professional societies. Lively discussions accompanied the presentations, and the major issues that were raised are discussed in the Breakout Sessions (below). The **need for an intelligent vehicle technology transfer process** clearly emerged from the presentations and the subsequent discussions among the participants.

PARTICIPANTS

There were more than **170 participants** at the conference, from **government** (several agencies), **industry** (defense and automotive), and **academia** (universities and professional societies).

The **list of registrants** follows. If you know anyone **who should be on the list**, and is not, please let us know via email at: RobertFinkelstein@compuserve.com. Likewise, please let us know if there are **errors in any entry** (e.g., spelling, affiliation, address, phone number).

Name	Title	Company	Address	Day Phone	Cell Phone	Fax	Email
Abbott, Scotty	Consultant	Soar Technology, Inc.	PO Box 662, Fort Knox, KY 40121	502-608-6968	502-608-6968	502-608-6968	scott.abbott@us.army.mil
Adams, William	Senior Analyst	L3 Comm-Titan	112 Konawa Way, Loudon, TN 37774	865-458-4045	573-578-9894	865-458-4045	bill.adams@titan.com
Amboyer, Donald		Macomb Community Coll	14500 E 12 Mile RD D-217, Warren, MI 48088	586-445-7169	248-935-7047	586-445-7316	amboyerd@macomb.edu
Atkinson, Jerry	Vice President	JADI Inc.	5800 Crooks Road, Troy, MI 48098	248-828-0594	248-672-6163	248-828-0595	jerry.atkinson@jadi.us
Ayyub, Bilal	Professor	Univ. of Maryland	Dept. of Civil Eng., College Park, MD 20742	301-299-9375		301-299-9377	ba@umd.edu
Bansal Suresh	Director, Auto Eng. Inst.	Lawrence Technological Univ.	21000 W. Ten Mile Road, Southfield, MI 48075-1058	248-204-2563		248-204-2576	bansal@ltu.edu
Barnes, Robert	Instructor, Joint Mil. Robotics	US Army War College (Booz Allen Hamilton)	Collins Hall RM-B035, Carlisle Barracks, PA 17013	717-245-4277	304-279-8424	717-245-4463	robert.c.barnes@us.army.mil
Barnhard, David	Knowledge Engineer	Applied Systems Intelligence, Inc.	11660 Alpharetta Hwy, Ste 720 Roswell, GA 30076	770-518-4228 x 244		770-619-0066	dbarnhard@asinc.com
Batty, Richard	Innov. Process Architect	Ford Motor Company	Ford Systems Integration Cntr, 1000 Republic Drive, Ste 600, Allen Park, MI 48101-3614	313-322-0147	248-342-3339		rbatty@ford.com
Bechtel, James	Computer Engineer	US Army TARDEC	1828 Windwood , Apt. 103 Rochester Hill, MI 48307	586-574-7016	586-306-5216		James.bechtels@us.army.mil
Beckemeyer, Curt	VP, Transp.	Applied Research Assoc	505 West University Ave., Champaign, IL 61820	217-356-4500	217-369-4554	217-356-3088	cbeckemeyer@ara.com
Beiker, Sven	Senior Engineer	BMW of N. America	555 Hamilton Ave., Palo Alto, CA 94301	650-473-2008	650-224-7303	650-473-2010	sven.beiker@bmw.de
Bell, William	Mktng. Manager	Rockwell Collins	5240 Huron Hills Dr., Commerce Twp., MI 48382	248-360-3922	218-346-2921	248-360-3944	wdbell@rockwellcollins.com
Berg, Johnny	Senior Physicist	Ionatron, Inc.	3590 E. Columbia, Tucson, AZ 85748	520-917-4245	520-204-0373	520-622-3835	jberg@ionatron.com
Bishop, Richard	Owner	Bishop Consulting	PO Box 80, Woodstock, MD 21163	410-461-8067	443-695-3717	410-461-8173	richardbishop@mindspring.com
Boparai, Harbir	Ldr, Finance/PR	UBC ERM3 Thunderbird Robotics	Bldg. 7, 2880 Wesbrook Mall, Vancouver, BC V6T 2J3 Canada	778-231-7784	778-231-7784		harbir.boparai@gmail.com
Boyse, John	Chair, Elec. & Comp Eng.	Lawrence Technological Univ.	21000 West Ten Mile Road, Southfield, MI 48075	248-204-2543	248-224-6006	248-204-2527	boyse@ltu.edu
Brandt, Charles	CTO	Technology Collaborative	12 Federal St., Ste. 420, Pittsburgh, PA 15212	412-201-7422	412-260-8257	412-201-3444	chuckb@techcollaborative.org
Brooke, Lindsay	Senior Editor	Automotive Engineering Intl.	755 W. Big Beaver Rd., Ste 16000, Troy, MI 48084	248-273-4091		248-273-4082	abrooke@sae.org
Brucki, Mark	Dir., Technology Partnerships	Lawrence Tech. Univ.	21000 W. Ten Mile Rd., Southfield, MI 48075	248-204-2310	734-637-4022		mbrucki@ltu.edu
Buck, Neena	VP, Emerging Frontier	Strategy Analytics	199 Wells Ave. #108, Newton, MA 02459	617-614-0724	617-872-7123		nbuck@strategyanalytics.com

Burns, Terry	Executive Dir.	ManTech International	14119A Sullyfield Circle, Chantilly, VA 20151	703-814-8364	571-216-9701	703-378-3396	terry.burns@mantech.com
Cavalieri, Ronald	Bus Devel. Manager	M/A-Com Inc, Div of TYCO Electronics	1011 Pawtucket Blvd., Lowell, MA 01853	978-442-4394	508-951-7378	978-442-4490	cavalierir@tycoelectronics.com
Chapp, Ron		TACOM-FMTV	6501 E. 11 Mile MS 500, Warren, MI 48093	586-574-7481		586-574-5784	ron.chapp@us.army.mil
Cheok, Ka	President	JADI Inc.	5800 Crooks Road, Troy, MI 48098	248-828-0594	248-760-3231	248-828-0595	ka.cheok@jadi.us
Chung, Chan-Jin	Assoc. Professor	Lawrence Tech. Univ.	21000 W. Ten Mile Rd., Southfield, MI 48075	248-204-3504	248-703-3842	248-204-3518	chung@ltu.edu
Collins, Peyton	President	American Robot Corp	303 Robinson Rd., Imperial, PA 15126	724-695-9002		724-695-9001	peyton@americanrobot.com
Conn, Alan	Engineer	ArgonST	90 Laurel View Dr., Smithfield, PA 15478	724-564-4100			alan.conn@argonst.com
Conrad, Kevin	Program Manager, UGV	Lockheed Martin Missiles & Fire Control	P.O. Box 650003, Dallas, TX 75265	972-603-2681	817-797-5731	972-603-3398	kevin.l.conrad@lmco.com
Crilley, Frank	VP	HIS Inc.	515 King Street, Suite 330 Alexandria, VA 22314	703-518-5318	703-472-7509		hsi1@erols.com
Cryderman Moss, Beth	Program Manager	PTAC	3270 Wilson Street, Marlette, MI 48453	989-635-3561 X227	810-404-4559	989-635-2230	mossb@thumbworks.org
Cummins, Mike	Principal Eng.	MTS Technologies, Inc.	2301 W. Big Beaver, Suite 950, Troy, MI 48044	248-637-5125		248-637-5130	cumminsm@mtstech.com
Dahlgren, Darwin	President	Dahlgren LLC	1410 Production Rd., Fort Wayne, IN 46807	260-407-1750	612-670-1024	260-407-6448	ddahlgren@dahlgrenllc.com
Dallas, Andy	VP, Fed. Sys.	Soar Technology, Inc.	3600 Green Court, Ste. 600, Ann Arbor, MI 48105	734-327-8000	734-276-8921	713-913-8537	adallas@soartech.com
Darr, Chad	Dir., Emerging Technology	American Systems Tech. Inc.	888 W. Big Beaver Rd. Ste. 420, Troy, MI 48084	248-362-4100 x 34	734-635-1283	248-362-9950	cdarr@amsystech.com
Deacon, Amos	CEO	All Terrain Vehicle Corp.	812 W. Southern Ave., Orange, CA 92865	714-283-0794	714-222-8413	714-283-1169	amos@atvcorp.com
Dean, Dave	Lead Engineer	Pursuit Engineer	1280 Holden, Ste. 109, Milford, MI 48381	248-684-5125		248-684-5176	davedean@pursuiteng.com
Dean, Jason	President	Dean Technologies, Inc.	362 Caroll Close, Tarrytown, NY		516-537-2101	516-676-6720	bethesolution@aol.com
Debouk, Rami	Research Eng.	General Motors	30500 Mound, Warren, MI 48090	586-986-8085		586-986-3003	rami.debouk@gm.com
Dekoven, Elyon	Research Sci.	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000	310-430-5875	734-913-8537	dekoven@soartech.com
Denaro, Robert	VP, ADAS	Navteq	222 Merchandise Mart, Chicago, IL 60654	312-894-7085	847-275-8100	312-894-7150	bob.denaro@navteq.com
De Roo, Chris	Prog. Mgr., Intel Mobility	John Deere	14401 Carowinds Blvd. , Charlotte, NC 28273	704-587-2785		704-588-0926	deroochrisa@johndeere.com
DiAntonio, Steve	Dir., Bus. Devel.	Carnegie Mellon Univ. Robotics Institute	Ten 40 th Street, Pittsburgh, PA 15201	412-681-6935	412-973-4312	412-681-6961	sda@rec.ri.cmu.edu
Dickson, Walton	Chief	Army Maneuver Support Battle Lab	320 Manscen Loop, Ste 104, Leonardwood, MO 65473	573-563-6186		573-563-6187	Dickson@wood.army.mil
Doak, John	Area	DRS Technologies	1531 South Hills Blvd., Bloomfield Hills, MI	248-766-	248-766-		doakcsi@aol.com

Donne, Jeffrey	Representative Section Director	Robert Bosch Corp., RTC	48304 2 N. Shore Center, Ste 320, Pittsburgh, PA 15212	4603 412-323- 9405	4603 412-596- 5333	412-323- 9667	Jeffrey.donne@rtc.bosch.com
Doty, William	Project Engineer	DRS-TEM	110 Wynn Drive, Huntsville, AL 35805	256-716- 2790		256-716- 2730	bdoty@drs-tem.com
Dueweke, Neil	President	Robotic Workspace Technologies	5576 St. Andrew, Clarkson, MI 48348	248-790- 4781	248-790- 4781	239-466- 7270	ndueweke@comcast.net
Edwards, Lulu	Gen. Eng. Resch	US Army Eng. R&D Cntr	3909 Halls Ferry Rd., Vicksburg, MS 39180	601-634- 3644		601-634- 4128	lulu.edwards@erdc.usace.army.mil
Fair, Mike	Robotics Softwr Engineer	SAIC	8303 N. Mopac, #B-450, Austin, TX 78759	512-345- 2074 X33	512-699- 4209	512-795- 8077	fairm@saic.com
Farkas, Glenn	Project Manager	American Robot Corp	303 Robinson Road, Imperial, PA 15126	724-695- 9003		724-695- 9001	glenn@americanrobot.com
Finkelstein, Robert	President	Robotic Technology Inc.	11424 Palatine Dr., Potomac, MD 20854	301-983- 4194	301-980- 8402	301-983- 3921	RobertFinkelstein@compuserve.com
Freitas, Michael	Managing Director	U.S. DOT Intelligent Vehicle Joint Program	400 7 th Street SW, Washington, DC 20590	202-366- 9292		202-493- 2027	michael.freitas@fhwa.dot.gov
Fritsch, Mike	President	Zoom Info Systems	3201 Stellhorn Rd., Fort Wayne, IN 46808	260-399- 1643		260-492- 0452	mfritsch@zoominfosystems.com
Furtwangler, Steve	Software Eng.	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327- 8000	616-308- 4298	734-913- 8537	sfurtwangler@soartech.com
Garber, Noal	Tech. Sales Eng.	Dspace	28700 Cabot Drive, Novi, MI 48377	248-567- 1233	248-459- 1680	248-567- 0130	ngarber@dspaceinc.com
Garner, Benjamin	R&D Ops Officer	U.S. Army (TRADOC S&T Div., Futures Cntr)	30 Ingalls Road, Ft. Monroe, VA 23651	757-788- 3879		757-788- 3445	benjamin.garner@monroe.army.mil
Goldberger, James	VP, Bus. Devel.	Canesta	965 W Maude Ave., Sunnyvale, CA 94085	408-530- 1504	408-799- 3360	408-530- 1527	jgoldberger@canesta.com
Green, Christopher	Sr. Rsrch Engineer	Keweenaw Research Center	23620 Airpark Blvd, Calumet, MI 49913	906-487- 2658		906-487- 2202	cagreen@mtu.edu
Guo, Jinhua	Assistant Prof.	University of Michigan	4901 Evergreen Rd., 211 CIS, Dearborn, MI48128	313-583- 6439		313-593- 4256	jinhua@umich.edu
Harvey, Martin	President	Coroware Test Labs	414 S. Craig St. #272, Pittsburgh, PA 15213	800-646- 2676 X721	425-802- 2223	800-641- 2676	mharvey@corolabs.com
Heffner, Ina	Associate VP, Technology	Metro Transit Authority of Harris County, TX	1900 Main Street, PO Box 61429, Houston, TX 77208	713-652- 7979	832-875- 1199	713-758- 7990	lh03@ridemetro.org
Hobson, James	Special Proj Eng	Merrill Tool and Machine	5250 Whispering Oak, W. Bloomfield, MI 48322	249-865- 7233	248-444- 7248	248-865- 9817	jhobson@merrilltool.com
Huber, Mark	Manager	Daimler Chrysler	800 Chrysler Drive, Auburn Hills, MI 48326	248-576- 0327			mah@dcx.com
Hudson, Edison	Dep. Dir., Rsrch	iRobot Corp.	63 South Ave., Burlington, MA 01803	781-418- 3409	919-215- 9358		ehudson@irobot.com
Hudson, Eugene (Cliff)	Manager	OSD, DOD Joint Robotics Program	OSD, Room 3B1060, Pentagon, Wash, DC 20301-3090	703-697- 3411		703-693- 7029	eugene.hudson@osd.mil
Hunn, David	Director, Mech. Engineering	Lockheed Martin Missiles & Fire Control	P.O. Box 650003 MISEM-16, Dallas, TX 75265-0003	972-603- 1842	972-741- 0292	972-603- 7030	david.hunn@lmco.com
Johnson, James	Director, Tech Management	Concurrent Technologies Corp.	11 Brendan Way, Greenville, SC 29615	864-271- 8188		864-233- 5527	johnsons@ctc.com

Johnston, Richard	Professor, Ele Dept.	Lawrence Tech Univ.	21000 W. Ten Mile, Southfield, MI 48075	248-204-2435	248-444-0274	248-204-2507	Johnston@ltu.edu
Jones, Chris	Robotics Res.	iRobot Corp.	63 South Ave., Burlington, MA 01803	781-418-3146		781-345-0201	cjones@irobot.com
Jones, Joseph	VP, Spec. Appl.	Acro Automation Systems	2900 W. Green Tree Rd., Milwaukee, WI 53209	414-352-4540	414-467-8124	414-352-1609	jjones@acro.com
Jorden-Pedersen, Jessica	COO	RE2	Suite 222, 10 Fortieth St., Pittsburgh, PA 15201	412-681-1697		412-681-5904	Jessica@resquared.com
Juberts, Maris	Supervisor, Robotic Veh.	U.S. Dept. of Commerce/NIST	100 Bureau Drive, Gaithersburg, MD 20899	301-975-3424	301-814-1539	301-990-9688	juberts@cme.nist.gov
Kaczperski, Jeff	President	Omega Plastics	24401 Capital, Clinton, MI 48036	586-954-2100 X 2904	586-420-1078	586-954-2122	jeffk@opinc.com
Kawazoe, Hiroshi	Manager	Nissan Technical Center North America, Inc.	196 Van Buren St., Suite 450, Herndon, VA 20170	703-456-2552	571-228-3108	703-456-2551	hiroshi.kawazoe@nissan-usa.com
Klatt, Erich	Business Devel.	Re2	10 40 th Street, Suite 222, Pittsburgh, PA 15201	412-681-6382	412-508-6430	412-681-5904	erich@resquared.com
Kluge, Karl	Senior Scientist	SAIC	311 S. Craig, Suite 105, Pittsburgh, PA 15213	412-683-2063	720-339-3016		klugek@saic.com
Knichel, David	Chief, Robotics Branch	US Army	320 Manscen Loop, Ste, Ft Leonardwood, MO 65473	573-596-0131 X64691			david.knichel@us.army.mil
Knipling, Ronald	Senior Research Scientist	Virginia Tech Transportation Institute	7054 Haycock Rd. #434, Falls Church, VA 22043	703-538-8439	703-304-3887	703-538-8450	rknipling@vtti.vt.edu
Kohn, Daniel	Mil. Acct Mgr	Hayes Lemmerz	15300 Centennial Dr., Northville, MI 48167	734-737-5655	734-546-0287	734-373-5955	dkohn@hayes-lemmerz.com
Konofalski, Tomasz	President/CEO	CAD Helper	46864 Fox Run Dr., Macomb, MI 48044	586-286-0355	586-873-1025		tomasz-konofalski@hotmail.com
Koo, Yeondeog	Def Sci Attache	Korean Embassy	2400 Wilson Blvd., Arlington, VA 22201	703-243-2777	202-812-1002		yeondkoo@msn.com
Koss, Frank	Senior Sys Eng.	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000 X203		734-913-8537	koss@soartech.com
Kruse, Bradley	Business Devel. Manager	Tyco Electronics/ M/A-Com	900 Wilshire Dr., Ste 150, Troy, MI 48084	248-273-3346	248-670-7907	248-273-3322	kruseb@tycoelectronics.com
Lane, Gerald	Dir., Grt. Lakes	Applied Research Assoc.	48320 Harbor Dr., Chesterfield Twp, MI48047	586-242-7778	586-242-7778	802-234-9420	jlane@ara.com
Larsen, Robert	Program Mgr.	Draper Laboratory	555 Technology Sq, Cambridge, MA 02139	617-258-1863	617-596-8034	617-258-3007	rob@draper.com
Lee, Seok	General Mgr.	Rotem Company	7314 19 Mile Rd., Sterling Heights, MI 48314	586-254-5600	248-709-3537	586-254-5603	sulee@rotemusa.com
Lien, Steven	Managing Dir.	Honeywell	21111 N. 19 th Ave., Phoenix, AZ 85027	602-436-1582	602-421-2368	602-436-1700	Steven.lien@honeywell.com
Lin, Wei-Cheng	Consultant	Honeywell	7123 Linden Terrace, Carlsbad, CA 92009	760-470-6566	760-470-6566		Wilson.lin@honeywell.com
Lindauer, Barbara	VP, Bus. Devel.	GD Robotic Systems	1234 Tech Court, Westminster, MD 21157	410-876-9200		410-876-9470	blindauer@gdrs.com
Lisse, Sean		Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI	734-327-	734-657-	734-913-	lisse@soartech.com

Losh, Michael	V.P. Auto Bus. Unit	American Systems Tech. Inc.	48105 888 W. Big Beaver Rd. Ste 710, Troy, MI 48084	8000 248-362-4100 X 24	2779 248-250-3498	8537 248-362-9950	mlosh@amsystech.com
Lowe, Emanuel	Project Manager	Applied Systems Intelligence, Inc	11660 Alpharetta Hwy, Ste 720 Roswell, GA 30076	770-518-4228 x 210		770-619-0066	mlowe@asinc.com
Mahmud, Syed	Associate Prof.	Wayne State University	5050 Anthony Wayne Dr., Detroit, MI 48202	313-577-3855	248-207-3259	313-577-1101	smahmud@eng.wayne.edu
Malkiewicz, Kimberly	Electrical Engineer	TACOM	6501 E. 11 Mile, MS 500, Warren, MI 48397	586-574-6848		586-574-5784	Kimberly.malkiewicz@us.army.mil
Matsui, Claude		HQDA	4008 Southland Rd., Rockville, MD 20853	202-877-7547	301-873-2316	301-871-0204	Claude.matsui@hqda.army.mil
Mazhar, Mohammad	Sr. Project Engineer	TACOM-TARDEC	2486 Evergreen Ct., Rochester Hills, MI 48309	586-574-6295		586-574-7593	mazharm@tacom.army.mil
McCormick, Scott	President	Connected Vehicle Trade Association	51037 Weston Drive, Plymouth, MI 48170	734-354-0546	734-730-8665	734-446-0326	sjm@connectedvehicle.org
McLeod, Hugh	Director	Radian Inc.	575 Robbins Dr., Troy, MI 48083	248-577-8100	248-249-5608	248-577-8111	hmcLeod@radianinc.com
Meitzler, Thomas	Research Eng.	RDECOM TARDEC	6501 E. 11 Mile Rd., Warren, MI 48397-5000	586-574-5405 X6145			meitzlet@tacom.army.mil
Meyer, Timothy	Dir. Bus. Devel.	HD Systems, Inc.	89 Cabot Court., Hauppauge, NY 11788	631-231-6630	516-578-5983	631-231-6803	tmeyer@hdsi.net
Milkie, Thomas	Dir., Robotics	SARA, Inc.	6300 Gateway Dr., Cypress, CA 90630	714-224-4410	714-791-3807	714-224-1710	tmilkie@sara.com
Mirelez, Daniel	Account Mgr.	Amer. Systems Tech. Inc.	888 W. Big Beaver Rd. Ste. 420, Troy, MI 48084	248-362-4100 x 15	985-768-0245	248-362-9950	dmirelez@amsystech.com
Morgan, Geoffrey	Software Eng.	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000	814-441-4943	734-913-8537	gmorgan@soartech.com
Morris, Patricia	Client Mgr Grt Lakes	Intel Corporation	3141 Woodcreek Way, Bloomfield Hills, MI 48304	248-334-1733	248-760-8108	248-334-1735	patricia.morris@intel.com
Moudgal, Vivek	Director, Sales	Dspace Inc.	28700 Cabot Drive Ste. 1100 Novi, MI 48377	248-567-1262	248-417-2306	248-567-0130	vmoudgal@dspaceinc.com
Murphy, Anne	Human Factor Engineer	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000	734-649-4534	734-913-8537	akgmurphy@soartech.com
Murphy, Ray	ITS Specialist	US DOT Federal Highway Admin.	19900 Governors Dr., Ste. 301, Olympia Fields, IL 60461	708-283-3517	708-574-8140	708-283-3501	ray.murphy@fhwa.dot.gov
Murtha, Suzanne	Director	ITS America (Vehicle Safety Systems)	1100 17 th St. NW, Ste 1200, Washington, DC 20036	202-721-4224	202-689-4802		smurtha@itsa.org
Myers, Scott	President	GD Robotic Systems	1234 Tech Court, Westminster, MD 21157	410-876-9200		410-876-9470	smyers@gdrs.com
Nimmer, Stephen	Dir, Def. Pgms	Oshkosh Truck Corp.	2307 Oregon St., Oshkosh, WI 54903	920-233-9280		920-233-9540	snimmer@oshtruck.com
Novosad, Stephen	Assist. Director	Southwest Research Inst.	6220 Culebra Rd Bldg. 97, San Antonio, TX 78238	210-522-2039	210-378-2714	210-522-3396	Stephen.novosad@swri.org
Osentoski, Larry	Division Mgr.	MTS Technologies Inc.	2301 W. Big Beaver, Suite 950, Troy, MI 48084	248-637-5127		248-637-5140	osentoskil@mtstech.com
Owens, Silvia	Small Bus. Spec.	US Army TACOM	AMSTA-CS-CB, TACOM, Warren, MI 48397	586-574-7523		586-574-5381	owenss@tacom.army.mil

Ozdemir, Tayfun	President	Virtual EM Inc.	2019 Georgetown Blvd., Ann Arbor, MI 48105	734-222-4558	734-846-2550	734-661-0159	tayfun@virtualem.biz
Ozguner, Umit	Professor	Ohio State University	2015 Neil Ave., Columbus, OH 43210	614-292-5940		614-292-7596	ozguner.1@osu.edu
Parraz, John	Chief, Software Testing	U.S. Army Aberdeen Test Center (UGVs)	400 Colleran Road, APG, MD 21005-5059	410-278-4622		410-278-4964	john.parraz@atc.army.mil
Paulet, Steven	Director, Bus. Dev.	PercepTek, Inc.	12395 N. Medway, Littleton, CO 80125	720-344-1037 X124	720-323-8079	720-344-2360	steven.paulet@perceptek-robotics.com
Pearly, Gregory	Bus. Dev. Mgr.	BAE Systems	1205 Coleman Ave., Santa Clara, CA 95050	408-202-0239			greg.pearly@baesystems.com
Pedersen, Jessica	COO	RE2, Inc.	10 40 th Street, Pittsburgh, PA 15201	412-681-1697	412-443-9434	412-681-5904	jessica@resquared.com
Pedersen, Jorgen	President -CEO	RE2, Inc.	10 40 th Street, Pittsburgh, PA 15201	412-681-6382	412-398-0949	412-681-5904	jorgen@resquared.com
Piegdon, Nicholas	Software Eng.	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000		734-913-8537	piegdon@soartech.com
Porreca, David	Dir., Bus. Devel.	SAE International	400 Commonwealth Dr., Warrendale, PA 15096	724-772-7186	412-512-7182	724-776-6622	dporreca@sae.org
Prikopa, Charles	Bus. Develop.	BAE Systems E & IS	14159 Edison Drive, Warren, MI 48088	586-588-0749		586-775-0130	chuck.prikopa@baesystems.com
Radzwion, Mark	District Manager	Russell Associates	39293 Plymouth Rd., Livonia, MI 48150	734-953-1752	734-732-1941	734-953-1773	mark_radzwion@pall.com
Ramioulle, Frederic	VP, Business Innovation Ctr.	Honeywell	2111 N. 19 th Ave, Phoenix, AZ 85027	602-436-4146	602-206-1565		frederic.ramioulle@honeywell.com
Reid, Bonnie	Program Mgr.	General Motors	30500 Mound Rd., Warren, MI 48090	586-986-6021	248-840-5971		bonnie.reid@gm.com
Rigas, Elias		US Army Research Lab Robotics Prog. Office	Bldg. 1121, AMSRD-ARG-WM-RP, Aberdeen Proving Ground, MD 21005	410-278-8809		410-278-9668	erigas@arl.army.mil
Rohlfing, Bill	Program Mgr.	Triad Services Group	1750 Lincoln Ave., Madison Hts. MI 48071	248-581-0535	248-933-9093	248-581-3302	bill.rohlfing@triadservicesgroup.com
Romano, Richard	President	Realtime Technologies	1517 N. Main Street, Royal Oak, MI 48067	248-705-0705		248-548-6036	romano@simcreator.com
Rosbe, Jim	President	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000	734-846-3126	734-913-8537	rosbe@soartech.com
Rosenblum, Jay	Dir., Bus. Devel.	GD Robotic Systems	1234 Tech Court , Westminster, MD 21157	410-876-9200		410-876-9470	jrosenblum@gdrs.com
Rupp, Jeffrey	Mgr Active Sfty	Ford Motor Co.	4216 Spring Lake Blvd., Ann Arbor, MI 48108	313-322-0949			jrupp@ford.com
Russell, Gerard	Account Mgr.	Cobasys	3740 Lapeer Road S, Orion, MI 48359	248-620-5777	314-477-6326	248-620-5702	grussell@cobasys.com
Sarna, Donald	Eng. Consultant	DCS Corp. Subcontract	1561 Caliper Dr., Troy, MI 48084	586-753-2600	248-935-0702		sarnad@tacom.army.mil
Schab, John	Program Mgr.	Trideum Corporation	1507 Whistler Road, Bel Air, MD 21015	410-278-9415	248-935-3602		John.schab@atc.army.mil
Sheng, Weihua	Assistant Prof.	Kettering University	1700 West 3 rd Ave., Flint, MI 48505	810-762-9500 x 5656	517-214-3078	810-762-9830	wsheng@kettering.edu
Shinn, James	VP, Sector Mgr.	Applied Research	415 Waterman Rd., S. Royalton, VT 05068	802-463-	802-233-	802-234-	jshinn@ara.com

Shoemaker, Chuck	Manager	Assoc. US Army Research Lab Robotics Program	Aberdeen Proving Ground, MD 21005-5066	8348 410-278-8810	0068	9420 410-278-9668	cshoe@arl.mil
Simmonds, J. Todd	Principal	Concurrent Technologies Corp.	211 Industrial Park, Johnstown, PA 15904	814-262-2387	412-818-4979	814-269-2700	simmondsj@ctc.com
Smid, Gert	Rsrch Scientist	JADI inc.	5800 Crooks Road, Troy, MI 48098	248-828-0594		248-828-0595	edzko.smid@jadi.us
Smith, Gregory	Computer Spec	Ford Motor, Co.	706 W. Liberty, Ann Arbor, MI 48103	313-337-6842		313-337-5432	Gsmith11@ford.com
Streelman, Gary	Tech. Mgr.	Delphi	5725 Delphi Dr., Troy, MI 48098	248-813-2992	248-860-1819	248-813-3220	gary.streelman@delphi.com
Taqbeem, Ehsan	Portfolio Mgr.	Daimlerchrysler	800 Chrysler Drive, Auburn Hills, MI 48326	248-576-0890			Et12@daimlerchrysler.com
Taraman, Sanaa	Prof. Mech. Eng.	Lawrence Tech. Univ.	21000 W. Ten Mile Rd., Southfield MI 48075	248-204-2531		248-204-2576	S_taraman@ltu.edu
Tasich, Jason	Senior Engineer	GD Land Systems	38500 Mound Rd., Sterling Hts, MI 48310	586-825-5119		586-825-5885	tasichj@gdls.com
Theisen, Bernard	Mgr Autonom. Navigation	U.S. Army TARDEC	6501 E. Eleven Mile Road, AMSRD-TAR-R/M.S. Warren, MI 48037-5000	586-574-8750	586-556-7217	586-574-8684	theisenb@tacom.army.mil
Thomas, David	Associate Dir.	US Army TACOM	MS264 6501 E. 11 Mile Rd., Warren, MI 48397-5000	586-574-6160	586-530-7805	586-574-5008	thomadav@tacom.army.mil
Thomasmeyer, William	Executive VP	The Technology Collaborative	12 Federal Street, Pittsburgh, PA 15212	412-802-0692	412-576-8388	412-802-0779	billt@techcollaborative.org
Torbin, Robert	Mgr. Bus. Devel	Foster-Miller, Inc.	350 Second Ave., Waltham, MA 02451	781-684-4369	617-347-9065	781-890-3489	btorbin@foster-miller.com
Tourner, Munira	Asst. Tech. Dir.	US Army TARDEC	6501 E. 11 Mile Rd., Warren, MI 48397-5000	586-574-8609	248-342-6552	586-574-6013	tournerm@tacom.army.mil
Turner, Wendy	Admin.	Pursuit Engineering	1280 Holden , Ste. 109, Milford, MI 48381	248-684-5125	810-333-6006	248-684-5176	wendy@pursuiteng.com
Uhl, Bill	Acct. Mgr.	dSPACE, Inc	2324 Dahlia Street, Denver, CO 80207	303-388-9664	248-417-2928	303-265-9651	buhl@dspaceinc.com
Underwood, Donald	Dir., Adv. Concepts	DRS Test and Energy Management, Inc.	110 Wynn Drive, Huntsville, AL 35805	256-716-2779	256-990-5084	256-895-2365	dunderwood@drs-tem.com
Valentine, Andrew	Principal Rsrch Scientist	Battelle	505 King Ave., Columbus, OH 43201	614-424-7477	614-571-4548	614-424-7312	valentinea@battelle.org
Van Tassell, David	Account Manager	Acro Automation Systems	2900 W. Green Tree Rd., Milwaukee, WI 53209	414-352-4540	414-758-8842	414-352-1609	dvantassell@acro.com
Wank, James	V.P. Army Prog.	Defense Products Mktng.	54873 Burlington Dr, Shelby Twp, MI 48315	586-786-9965	586-770-1578	586-786-9962	dpmmijw@aol.com
Watts, Robert	Engineer	US Army TARDEC	57221 Covington Dr, Wash. Twp. MI 48094	586-574-5280		586-574-5008	bob.watts@us.army.mil
Weisel, Walter	Chairman & CEO	Innova Holdings, Inc.	17105 San Carlos Blvd., A6151 , Ft. Myers Beach, FL 33931	239-466-0488	239-770-7019	239-466-7270	walt@innovaholdings.com
Westrick, Bill	Dir. Of Develop.	Zoom Information Sys.	3201 Stellhorn Rd., Fort Wayne, IN 46808	260-399-1646		260-492-0452	bwestrick@zoominfosystems.com
Wiercienski, Wojciech	ITS Engineer	Ministry of Transportation, Ontario	ITS Office, 3 rd Fl., 1201 Wilson Ave., Downsview Ont, M3M1J8 Canada	416-235-3451		416-235-5224	Wojtek.wiercienski@mto.gov.on.ca

Witus, Gary	President	Turing Associate	1392 Honey Run Dr., Ann Arbor, MI 48103	734-665-4818		734-741-8788	witusg@umich.edu
Wise, Joel	Chief, TM Div, RS JPO	US Army, RS JPO	3221 Snooper Rd., Redstone Arsenal, AL 35398-8060	256-955-0767	256-655-7244	256-842-0947	joel.wise@redstone.army.mil
Wood, Scott	VP, Strategy	Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000	734-657-7477	734-913-8537	swood@soartech.com
Wynbelt, Walter	Army Prog Mgr.	DPM	4002 Hillsdale, Auburn Hills, MI 48326	248-340-9874	248-202-4920	248-371-1743	wynbelt@comcast.net
Yakes, Chris	Chief Eng.	OshKosh Truck Corp.	2307 Oregon St., Oregon, WI 54903	920-233-9689	920-410-4529		cyakes@oshtruck.com
Yamauchi, Brian	Lead Roboticist	I Robot	63 South Avenue, Burlington, MA 01803	781-418-3291	617-699-8625	781-345-0201	yamauchi@irobot.com
Yancey, Drew	VP Operations	AZCO	17236 E. Kensington, Fountain Hills, AZ 85218	480-216-7521	480-216-7521	602-283-1403	Drew1063@msn.com
Youngblood, Rick	Bus. Dev. Mgr.	Eaton Corp. (VORAD)	13100 East Michigan Ave., Galesburg, MI 49053	269-342-3058	269-209-0170	269-746-6058	richardjyoungblood@eaton.com
Zaientz, Jack		Soar Technology, Inc.	3600 Green Court, Ste 600, Ann Arbor, MI 48105	734-327-8000	734-645-7971	734-913-8537	jzaientz@soartech.com
Ziegler, Jim	CEO	MechFoundry	1700 Wildwood Ave., Jackson, MI 49202	517-783-5343	517-262-7386	517-783-6626	jim.ziegler@mechfoundry.com
Zimmerman, Jody	VP, Federal	Transcore	8614 Westwood Center Dr., Vienna, VA 22182	571-331-3020	571-331-3020	703-288-1238	jody.zimmerman@transcore.com

STEERING COMMITTEE

A **Steering Committee** of volunteers was formed at the initial Workshop held at NIST on 26 July 05. The purpose of the Steering Committee is to provide valuable guidance and assistance for the initiation and subsequent operation of the IVTT. The Steering Committee will convene for a meeting once or twice a year, and participate in IVTT on-going decision-making through the proposed IVTT website, email, and voice communications. You are encouraged to join. If you are interested in **volunteering** to serve on the Steering Committee, please email us at RobertFinkelstein@compuserve.com. Also, please let us know if you are on the Steering Committee but are no longer able to serve. **The 39 distinguished members of the Steering Committee are:**

Richard Abraham, Staff Specialist, Autonomous Systems, Army TARDEC and OUSD
703-588-7419; richard.abraham@osd.mil

Bilal Ayyub, Professor & Director, Center for Technology & Systems Management, U. of MD;
301-405-1956; ayyub@umd.edu

Dick Bishop, President, Bishop Consulting
410-461-8067; RichardBishop@mindspring.com

Nina Buck, VP, Strategy Analytics
617-614-0724; nbuck@strategyanalytics.com

Wendell Chun, Manager, Robotics, Lockheed-Martin Corp.
303-971-7945; wendell.h.chun@lmco.com

Beth Cryderman-Moss, Program manager, PTAC
989-635-3561; mossbthumbworks.org

Darwin Dahlgren, President, Dahlgren LLC.
260-407-1750; ddahlgren@zoominfosystems.com

Andy Dallas, VP, Soar Technology, Inc.
734-327-8000 x214; adallas@soartech.com

Jason Dean, President, Dean Technologies Inc.
516-537-2101; bethesolution@aol.com

Conal Deedy, Manager, Volvo Technology of America
336-393-2647; conal.deedy@volvo.com

Elyon DeKoven, Research Scientist, Soar Technology Inc.
734-327-8000 X216; dekoven@soartech.com

Jeff Donne, Manager, Bosch Research and Development USA
412-323-9405; Jeffrey.Donne@RTC.Bosch.com

Robert Finkelstein, President Robotic Technology Inc.
301-983-4194; RobertFinkelstein@compuserve.com

Mike Freitas, Manager, DOT Intelligent Transportation Systems
202-366-9292; Michael.Freitas@fhwa.dot.gov

Mark Huber, Manager, Active Safety, Daimler Chrysler
248-576-5569; MAH@DCX.com

Edison Hudson, Deputy Director Research, iRobot Corp.
781-418-3409; ehudson@irobot.com

Jessica Jordan-Pedersen, COO, RE2
412-681-1697; jessica@resquared.com

Maris Juberts, Manager, Intelligent Control of Mobility Systems (ICMS), NIST
301-975-3422; juberts@cme.nist.gov

Tomasz Konofalski, President/CEO, CAD Helper
586-286-0355; tomasz_konofalski@hotmail.com

Syed M Mahmud, Associate Professor, Wayne State University
313-577-3855; smahmud@eng.wayne.edu

Scott McCormick, President, Connected Vehicle Association
734-354-0546; sjm@connectedvehicle.org

Thomas Milkie, Director, Scientific Applications and Research Associates, Inc.
714-224-4410 x208; tmilkie@sara.com

Umit Ozguner, Professor, Ohio State University
614 292 5940; ozguner.1@osu.edu

David Porreca, Director, Strategic Partnerships & Business Development, SAE International
724-772-7186; DPorreca@sae.org

Venkat Pindiprolu, Mgr., Vehicle Automation, Federal Transit Administration
202-366-8061; venkat.pindiprolu@fta.dot.gov

Frederic Ramiouille, VP & General Manager, Honeywell Aerospace
602-436-4146; frederic.ramiouille@honeywell.com

Jay Rosenblum, Director, Business Development, General Dynamics Robotic Systems
410-876-9200; jrosenblum@gdrs.com

James Rosbe, President, Soar Technology
734-327-8000 x206; rosbe@soartech.com

Glenn Rossi, Manager, Boeing Future Combat System Program
610-745-7440; glenn.t.rossi@boeing.com

John Schab, Program Manager, Aberdeen Test Center
410-278-9415; john.schab@atc.army.mil

J. Todd Simonds, Principal, Concurrent Technologies Corp.
814-262-2387; simonds@ctc.com

Ehsan Taqbeem, Portfolio Manager, Daimler Chrysler
248-576-0890; Et12@DaimlerChrysler.com

Bernard Theisen, Manager, Autonomous Navigation Team, U.S. Army TARDEC
586-574-8750; bernard.theisen@us.army.mil

David Thomas, Associate Director, Intelligent Systems, TARDEC
586-574-5008; thomadav@tacom.army.mil

Bill Uhl, Account Manager, dSPACE, Inc.
303-388-9664; buhl@dspaceinc.com

Walter Weisel, Chairman/CEO, Innova Holdings, Inc.
239-466-0488; walt@innovaholdings.com

Wendy Turner, Administrator, Pursuit Engineering
248-684-5125; wendy@pursuiteng.com

Wojtek Wiercienski, Engineer, Intelligent Transportation Systems, Ministry of Transportation
418-235-3451; Wojtek.Wiercienski@mto.gov.on.ca

Jim Ziegler, CEO, MechFoundry
517-783-1166; jim.ziegler@mechfoundry.com

BREAKOUT SESSIONS

The breakout sessions discussed some of the **key issues** concerning IVTT. **Three breakout sessions**, divided approximately equally among the participants, were held simultaneously and concerned: **Technology Transfer Framework; Technology Transfer Issues; and Technology Transfer Benefits.**

Technology Transfer Framework

According to the participants of this breakout session the process for establishing a framework for intelligent vehicle technology transfer should start with suitable **mission and vision statements**. They should identify the **meaning of technology transfer** for IVTT and identify **obstacles and opportunities** to achieve the mission. Early in the process, **identify organizations** with similar missions, and create a work-breakdown structure to accomplish the mission. Identify potential **sources of funding** and, in general **solicit general interest** in the mission and vision.

Technology transfer should also be treated as a **phenomenon** which takes place within organizations, as well as among organizations, industries, and nations. It is related to the area of **competitive intelligence**, which teaches (among other things) that it is necessary for **dedicated, full-time** individuals to manage the process of technology transfer for it to be efficacious. Technology transfer is not just an information pipeline; it can be a “contact sport.”

The **pre-competitive environment** is potentially a mine-field. It may be wise to focus (at least initially) on technologies in the **public domain** (i.e., not proprietary), as well as focusing on systems at a resolution above specific implementations of hardware. There are precedents for fruitful **pre-competition collaborations**, and one function could be to facilitate pre-competition collaborations, as well as creating and facilitating synergies among IVTT members. (**Synergy**, not just a suite of tools, should be part of the IVTT mission). Any knowledge generated by the IVTT should be **distributed equitably**. The optimum means of achieving technology transfer should be embedded in the mission of IVTT so that the **process itself** can evolve with experience and new technology.

There should be an effort to identify a mechanism for “real” technology transfer, with algorithms, not just papers. The IVTT should learn (perhaps through **automated data mining** as well as a **staff of data miners**) about new developments. Technology developers should be **connected** readily with those needing or wanting the technology.

The **IVTT website** should serve a number of **roles**. It will be the **public contact point** for the IVTT, with statements of mission, vision, and purpose. It will also serve as the major means of **communication and collaboration** among members. The traditional website model may not be applicable for the IVTT, and **alternative formats** (such as the Wiki style) should be explored. A corporate analog of a personals section (displaying those offering or needing technology) should be included.

The **content** of the IVTT website might be divided by system/subsystem area, where responsibilities might vary per area. There should be lists of members interested in **collaborations** and lists of (and links to) **professional organizations** with similar goals. Relevant **events** (e.g., conferences, workshops, courses, etc.) would be valuable. Members will be able to post their technology and system **needs and wants**, with contact information. Some areas might be **accessible** to the general public and other areas **restricted** to those with assigned

identification and passwords. The website could provide links and access to a variety of relevant **databases** and facilitate access to (searchable) lists of **OEMs** and **vendors**.

The IVTT will be active in organizing **workshops, conferences, and exhibits**, including **niche workshops** organized by specialized topic or subsystem areas. Larger conferences will focus on intelligent vehicles systemically, including an **annual event** that will serve as a technology showcase. There will be a digital and/or paper **journal**. The IVTT will join with other associations (including professional societies and trade associations), creating a **“virtual” association** to link with members of already existing associations.

To **publicize** the IVTT, it will be necessary to determine which media may be interested and to cultivate them. Each type of IVTT technology should be mapped into prospective publications and other media interested in that technology. It should be determined whether the IVTT constituency (military or civilian), however, would want media coverage or their names and affiliations publicized. The IVTT should publish weekly or monthly newsletters for posting on the website and dissemination via email to interested recipients, as well as disseminating news alerts and press releases. A digital and/or paper journal would also serve to publicize the IVTT along with disseminating formal, well-written papers concerning intelligent vehicle research, development, applications, and technology tutorials.

The **next steps** in establishing an IVTT framework are to: establish the **Steering Committee** and its mission; identify and list all prospective IVTT **stakeholders** (including government agencies, industry, academia, professional societies, sponsors, customers, users, organizations and individuals); design and implement a **website** and initial **newsletter**.

Technology Transfer Issues

There are many **competitive issues** to be addressed in establishing the IVTT, including:

- Intellectual Property
- Licensing
- Copyrights/information rights
- Exposure
- Government vs. commercial rights
- Introducing new competitors through technology transfer
- Inadvertent disclosure
- Rules for teaming and collaboration
- Building trust among members
- Fostering competition
- Due diligence

Liability issues to be considered include:

- Warrantee/guarantees that may be offered in conjunction with the IVTT
- Performance of the website and other aspects of the IVTT
- Risk management and mitigation for the enterprise

- Support through the technology life cycle
- Differences of exposure for various participants
- Legal precedence/default for the IVTT type of enterprise
- Commercial/military liability tolerance
- Certification requirements
- Government regulations
- Trace-ability for IVTT activities (postings, publications, public statements, etc.)

The IVTT **architecture** (of the website and entire organization) should be:

- Physically, functionally, and logically efficacious
- Be based on suitable standards, being compatible and adaptable and avoiding obsolescence

The **sustainability** of the IVTT process requires the assignment of responsibility for the enterprise (i.e., management responsibility). It also requires avoiding obsolescence of the website and the transfer process itself by updating technical information, software, and hardware, and by regular maintenance of the system. IVTT support staff should be trained appropriately, but **outsourcing** some of the service functions should be considered as well.

Information security is important because of considerations of both **intellectual property** and **national security**. Key **security issues** include:

- Information storage/transmission requirements
- Security policy
- Declassification process
- Dissemination/retention
- Classification process
- Foreign disclosure
- University publication requirements
- Facility security
- Competitive intelligence and industrial espionage
- Intellectual property rights (pre-existing and government)
- Trade secrets
- Foreign rights
- Open vs. closed source license
- Royalties

The **business process** in establishing the IVTT will require designing common partnering and participation agreements for government and industry. Rules of engagement must be established, along with a system for records processing and storage, auditing, accountability, business quality certification and a milestone review process.

The IVTT, which is likely to have participation by international companies, must also consider **cultural variations** concerning various technology transfer sensitive issues, including:

- Defense vs. commercial technology transfer
- Foreign vs. domestic
- Agency to agency
- Business to business
- Language, terminology, jargon
- Weights and measures (e.g., metric vs. English weights and measures)
- Business model variations
- Design for manufacturing
- Legal system (i.e., different in different countries)
- Ergonomics (e.g., differ for different ethnic groups or nationalities)
- Quality practices
- Documentation requirements

Various sources of **funding** must be contemplated for IVTT, including:

- Cost Sharing
- Source
- Resources
- Ownership
- R & D - testing
- Government furnished equipment (GFE)
- Public vs. private
- Domain rights
- Accounting models - private vs. government

Technology Transfer Benefits

There are many different **potential markets** and **enabling technologies** which could benefit by the IVTT, including:

- Sensor technology and sensor fusion
- Image processing (night vision)
- Object recognition (barcodes, RFID, data bucket)
- Active roadway signage
- Decision aids/control
- System integrity (reliability, fail-safe, risk analysis)
- Human machine interface
- Actuators
- Processor technology
- Standardized structures
- Standards
- Power management
- Communications (wired/wireless, between vehicle and infrastructure)
- Cost
- Miniaturization
- Software/control

- Digital map generation
- Security
- Memory technology/management
- Materials
- Traffic monitoring
- Cellular communications
- Emergency response
- Border security
- Reconfigurable, ad hoc networks
- Public transportation
- Farming
- Geological surveying
- Mining
- Emergency response
- Rescue operations
- In-home/personal assistance
- Postal delivery
- Border/facility security
- Port operations and management
- Inspection (power, gas, railroad, subway)
- Waste collection
- Toys
- Robot racing
- Construction (buildings and roads)
- Manufacturing
- HazMat cleanup
- Food delivery
- Facility care (warehousing, cleaning, inspection)
- Luggage handling
- Highway shoulder cleanup and snow plowing
- Non-emergency road assistance (tire changing, towing, triage, traffic management)
- Decision aiding/planning
- Driver assistance
- Collision detection and avoidance
- Tourism (vacation packages, guides)
- Vehicle infrastructure communication (smart intersections)
- Automobile re-fueling
- Vehicle maintenance
- Vehicle electronics (drive by wire, embedded processor, power management, sensors)
- Active controls (vehicle dynamics, stability, power, braking, traction, steering)
- Comfort (communication, interface, fatigue reduction)
- Navigation system (tracking, training, planning, adaptive)
- Diagnostics/prognostics (intelligent health monitoring, power-train, electronics, operator)
- Safety and security (“orphaned” vehicles, vehicular/infrastructure hijacking)

Value of the Breakout Sessions

The three breakout sessions confirmed the interest of the DOD and DOT vehicle communities in intelligent vehicle technology transfer. The suggestions they generated for the **technology transfer framework** will contribute to establishing a roadmap for the development and implementation of IVTT, especially the next steps that were recommended, such as convening a meeting of the **Steering Committee**. The highlighted **technology transfer issues** will serve as cautionary warnings of potential risks and opportunities for the IVTT, such as attentiveness to the **intellectual property** and **national security** concerns in disseminating information on intelligent vehicle technology. And the suggested manifold **benefits** to be obtained from the IVTT, such as advancements in **homeland security** and **in-home personal assistance**, will provide powerful motivation for shepherding the IVTT to its fruition.