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MTI

Eighth National Garrett Morgan Symposium on Sustainable Transportation

Report S-08-03 September 2008

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Eighth National Garrett Morgan Symposium on Sustainable Transportation

MTI

Mineta
Transportation
Institute

Created by
Congress in 1991

MINETA TRANSPORTATION INSTITUTE

The Norman Y. Mineta International Institute for Surface Transportation Policy Studies (MTI) was established by Congress as part of the Intermodal Surface Transportation Efficiency Act of 1991. Reauthorized in 1998, MTI was selected by the U.S. Department of Transportation through a competitive process in 2002 as a national "Center of Excellence." The Institute is funded by Congress through the United States Department of Transportation's Research and Innovative Technology Administration, the California Legislature through the Department of Transportation (Caltrans), and by private grants and donations.

The Institute receives oversight from an internationally respected Board of Trustees whose members represent all major surface transportation modes. MTI's focus on policy and management resulted from a Board assessment of the industry's unmet needs and led directly to the choice of the San José State University College of Business as the Institute's home. The Board provides policy direction, assists with needs assessment, and connects the Institute and its programs with the international transportation community.

MTI's transportation policy work is centered on three primary responsibilities:

Research

MTI works to provide policy-oriented research for all levels of government and the private sector to foster the development of optimum surface transportation systems. Research areas include: transportation security; planning and policy development; interrelationships among transportation, land use, and the environment; transportation finance; and collaborative labor-management relations. Certified Research Associates conduct the research. Certification requires an advanced degree, generally a Ph.D., a record of academic publications, and professional references. Research projects culminate in a peer-reviewed publication, available both in hardcopy and on *TransWeb*, the MTI website (http://transweb.sjsu.edu).

Education

The educational goal of the Institute is to provide graduate-level education to students seeking a career in the development and operation of surface transportation programs. MTI, through San José State University, offers an AACSB-accredited Master of Science in Transportation Management and a graduate Certificate in Transportation Management that serve to prepare the nation's transportation managers for the 21st century. The master's degree is the highest conferred by the California State University system. With the active assistance of the California Department of Transportation, MTI delivers its classes over a state-of-the-art videoconference network throughout the state of California and via webcasting beyond, allowing working transportation professionals to pursue an advanced degree regardless of their location. To meet the needs of employers seeking a diverse workforce, MTI's education program promotes enrollment to under-represented groups.

Information and Technology Transfer

MTI promotes the availability of completed research to professional organizations and journals and works to integrate the research findings into the graduate education program. In addition to publishing the studies, the Institute also sponsors symposia to disseminate research results to transportation professionals and encourages Research Associates to present their findings at conferences. *The World in Motion*, MTI's quarterly newsletter, covers innovation in the Institute's research and education programs. MTI's extensive collection of transportation-related publications is integrated into San José State University's world-class Martin Luther King, Jr. Library.

REPORT S-08-03

EIGHTH NATIONAL GARRETT MORGAN SYMPOSIUM ON SUSTAINABLE TRANSPORTATION

September 30, 2008

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16. Abstract

On April 1, 2008, the Mineta Transportation Institute at San José State University hosted a videoconference that brought together experts in surface transportation and students from middle and high schools across the nation to discuss the importance of sustainable transportation. The goal was to introduce students to future career opportunities in transportation and to inspire them to take the high school and college courses that will prepare them for professional careers. Students from California, Maryland and Virginia participated in the 2008 symposium, during which they heard opening remarks from Vice Admiral Thomas J. Barrett, Deputy Secretary of the U.S. Department of Transportation. Five teams of students presented their ideas on sustainable transportation alternatives for the future. These included a magnetic hover bus that can traverse both land and water, a plug-in electric-biodiesel-solar hybrid car, applications of the Stirling engine, a solar-hydropower bus, and an electric car with back-up power from solar panels and an internal windmill. The formal presentations were followed by a moderated question-and-answer session in which student teams questioned each other about their projects and sought the advice of experts about preparation for transportation careers and the critical issues they will face in the future. This publication is an edited summary of the April 2008 event, named in honor of Garrett A. Morgan, a black American inventor honored by Congress for his contributions to transportation and public safety.

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ACKNOWLEDGEMENTS

We are deeply grateful to the many people who contributed to this event. Foremost is former U.S. Secretary of Transportation Norman Y. Mineta for his continuing support of the Garrett A. Morgan Technology and Futures Program, an initiative that has influenced the lives of thousands of young people over the years.

We also extend special thanks to Vice Admiral Thomas J. Barrett, Deputy Administrator of the U.S. Department of Transportation, for so ably representing U.S. Secretary of Transportation Mary E. Peters. His dedication to ensuring the safety and sustainability of our transportation system and optimism about the creativity and capabilities of the next generation of transportation leaders set the stage for the entire symposium.

The success of the Garrett Morgan symposia series is a direct result of the volunteer efforts of the Mineta Transportation Institute's Board of Trustees and the individuals and organizations that sponsor the participating schools. In 2008, our sponsors were:

- Tate Jackson, Coordinator of the Transportation and Civil Engineering (TRAC) Program at the American Association of State Highway and Transportation Officials in Washington, D.C., who sponsored Ms. Barbara Musser's ninth-grade students from Leonardtown High School in Leonardtown, Maryland.
- Michael Townes, President/CEO and Tamara Poulson, Community Relations Specialist, both from the Hampton Roads Transit Agency, who sponsored Ms. Ebony Elijah and Ms. Jeanina Harris's sixth-grade students from the School of International Studies at Meadowbrook in Norfolk, Virginia.
- Alfonso Miles, Associate Caltrans Administrator, Caltrans District 4, who sponsored Ms. Fay Pisciotta's eighth-grade students from Edna Brewer Middle School in Oakland, California.
- Julia Bolger, Resource Manager and Janet Newland, Web Coordinator, Caltrans District 5, who sponsored Mr. Ayen Johnson's eighth-grade students from George Flamson Middle School in Paso Robles, California.
- Norma Quezada, Recruitment Officer, Caltrans District 12, who sponsored Ms. Emily Fellmer and Mr. Kevin Black's eighth-grade students from MacArthur Fundamental Middle School in Sana Ana, California.

We extend special appreciation to the transportation dignitaries who took time from their schedules to share their expertise, personal experiences and dedication to the transportation profession with our student participants. Our thanks go to:

- Vice Admiral Thomas J. Barrett, Deputy Administrator of the U.S. Department of Transportation;
- John Horsley, Executive Director of the American Association of State Transportation and Highway Officials;
- Will Kempton, Director of the California Department of Transportation;
- Norman Y. Mineta, former Secretary of the U.S. Department of Transportation; and
- Michael Townes, President/CEO of the Hampton Roads Transit Agency and Chair of the American Public Transit Association.

This nationwide videoconference would not have been possible without the support of technicians at the various videoconference sites. Thanks go to videoconference coordinators at the Caltrans District 7 Network Operations Center in Sacramento, California; Caltrans District 4 in Oakland, California; Caltrans District 5 in Paso Robles, California; Caltrans District 12 in Irvine, California; the Association of American Railroads in Washington, D.C.; and Vicom in Virginia Beach, Virginia.

For their work in producing this report, the Mineta Transportation Institute thanks the following individuals: Donna Maurillo, Director of Communications and Special Projects at MTI; Trixie Johnson, Director of Research at MTI; Sahil Rahimi, Student Assistant at MTI. Editing and publication services were provided by Lyn Long, Principal, hyper-graphia.com.

FOREWARD

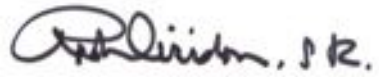
The Eighth National Garrett A. Morgan Symposium on Sustainable Transportation in the twenty-first century is part of the Mineta Transportation Institution's ongoing mission to provide information transfer, education and research on current issues and emerging solutions in the field of sustainable surface transportation.

This videoconference symposium is part of the Garrett A. Morgan Technology and Futures Program, which was established by former U.S. Secretary of Transportation Rodney Slater and continued through the support of former U.S. Secretary of Transportation Norman Y. Mineta and his successor, U.S. Secretary of Transportation Mary E. Peters.

In this year's competition, middle school and high school students from five U.S. schools addressed the topic of sustainable transportation and proposed innovations for the surface transportation industry. This account of the videoconference provides an interesting look into the thoughts of these students, who show great promise as the next generation of transportation leaders.

This publication is intended to give teachers and transportation professionals a glimpse into the creativity and capabilities of this emerging generation.

Thanks to the efforts of the many people acknowledged in this document, this event and publication will add to the spirit of progress and innovation exemplified by the life and works of Garrett Augustus Morgan (1877-1963), a black American inventor honored by the U.S. Congress for his contributions to transportation engineering and public safety.



Rod Diridon, Sr.
Executive Director

EXECUTIVE SUMMARY

On April 1, 2008, the Mineta Transportation Institute (MTI) continued its support of the U.S. Department of Transportation's Garrett A. Morgan Technology and Transportation Futures Program by conducting the Eighth National Garrett Morgan Symposium and Videoconference on Sustainable Transportation.

The purpose of this national videoconference was to stimulate the minds of young people and encourage them to pursue the academic programs that will prepare them for professional careers in transportation engineering, planning, administration and technology.

Purpose

The Garrett A. Morgan Technology and Transportation Futures Program was established in 1997 by former U.S. Secretary of Transportation Rodney E. Slater. The program has three cornerstone components:

- To establish a partnership among the U.S. Department of Transportation, state departments of transportation, public and private transportation providers and local communities to ensure that today's students are prepared to become the next generation of transportation leaders
- To develop a curriculum that can interest younger students in transportation and provide learning tools that can guide them to advanced academic and professional levels
- To provide the technologies that will enable students to develop skills that they can apply to future careers in transportation

Broadcast Sites

The videoconference was conducted through six broadcast sites:

- In Washington, D.C., the American Association of Railroads hosted students from Leonardtown High School in Leonardtown, Maryland. Their sponsor was Tate Jackson, Coordinator of the Transportation and Civil Engineering (TRAC) Program at the American Association of State Highway and Transportation Officials, Washington, D.C.
- In Virginia Beach, Virginia, Vicom hosted students at the School of International Studies at Meadowbrook from Norfolk, Virginia. Their sponsors were Michael Townes, President/CEO and Tamara Johnson, Community Relations Specialist, both from the Hampton Roads Transit Agency, Norfolk, Virginia.
- In Sacramento, California, Caltrans District 7 Network Operations Center hosted Will Kempton, Director, California Department of Transportation.
- In Oakland, California, Caltrans District 4 hosted students from the Edna Brewer Middle School in Oakland, California. Their sponsor was Alfonso Miles, Associate Caltrans Administrator, Caltrans District 4.
- In Paso Robles, California, Caltrans District 5 hosted the George Flamson Middle School in Paso Robles, California. Their sponsors were Julia Bolger, Resource Manager and Janet Newland, Web Coordinator, Caltrans District 5.

- In Irvine, California, Caltrans District 12 hosted the MacArthur Fundamental Middle School in Santa Ana, California. Their sponsor was Norma Quezada, Recruitment Officer, Caltrans District 12.

Event Highlights

The student teams were welcomed by a panel of dignitaries including Ron Diridon, Executive Director of the Mineta Transportation Institute; John Horsley, Executive Director of the American Association of State Highway and Transportation Officials; The Honorable Norman Y. Mineta, Former Secretary of the U.S. Department of Transportation; and Will Kempton, Director of the California Department of Transportation.

Vice Admiral Thomas J. Barrett, Deputy Secretary of the U.S. Department of Transportation, gave the keynote address. He encouraged students who are considering careers in transportation to embrace innovation, challenge conventional wisdom and use new technologies to solve old problems:

"Whether it's in areas related to engineering design and management, administration, planning and communications, or environmental design and mitigation we need your hands, your hearts and your spirit of innovation to guide us to solutions to sustain the transportation system of the 21st century."

Each school made a presentation that addressed one or more elements of sustainable transportation. Alternative fuels weighed heavily on the minds of his year's entrants.

- The School of International Studies at Meadowbrook students from Ms. Jeanina Harris and Ms. Ebony Elijah's sixth-grade class proposed the *Magnetic Hover Bus*, a mass transportation system that can traverse both land and water using totally renewable energy sources.

- Edna Brewer Middle School students from Ms. Fay Pisciotta's eighth-grade class proposed the *Ina Zuma Plug-In Biodiesel Hybrid Car.* This zero-emission car runs on electric, biodiesel and solar power, and can also provide power to the house.

- George Flamson Middle School students from Mr. Ayen Johnson's eighth-grade class proposed *Applications of the Stirling Engine*, a self-contained non-polluting energy source that uses the expansion of gases at high temperature to generate energy.

- Leonardtown High School students from Ms. Barbara Musser's ninth-grade class proposed a *Solar-Hydropower Bus* that can provide inexpensive totally-sustainable mass transportation using solar and hydroelectric power.

- MacArthur Fundamental Middle School students from Ms. Emily Fellmer's eighth-grade class proposed an *Electric/Solar/Windmill Powered Car,* designed to overcome the weaknesses of each of these technologies by incorporating all three in one vehicle.

A question-and-answer session followed the formal student presentations. This session was moderated by Donna Maurillo, Director of Communications and Special Projects at MTI. This

session was conducted in two parts. In the first part, students questioned each other about the technological feasibility and safety of their respective projects. In the second part, they asked transportation professionals about the nature of the transportation profession, how they can prepare for transportation careers and what challenges they are likely to face in the future.

Winning Student Team

The Edna Brewer Middle School in Oakland, California, was the winner of the 2008 Garrett Morgan competition for their *Ina Zuma Plug-In Biodiesel Hybrid Car*. [In martial arts, Ina Zuma means "lightening flash"]. This zero-emission car runs on electric, biodiesel and solar power. When coupled with the team's other proposal – solar panels for each household that buys an Ina Zuma – household costs for electric power can also be reduced.

The five student presenters, who were chosen by their own classmates, organized themselves as a corporate entity, "Brewer Cars." The corporate team included Duy Truong, Chief Executive Officer; Tori Duong, Marketing Director; Aaron Lee, Plug-In Hybrid Research Manager; Martha Cardenas, Biodiesel Research Director; and Harold Townsend, Legal Representative.

Edna Brewer Middle School, Eighth Grade, with their *Ina Zuma Plug-In Biodiesel Car.* Top row, left to right: Monica Wilson, Caltrans District 4; Rod Diridon, MTI; Donna Maurillo, MTI; Alfonso Miles, Caltrans District 4; teacher Fay Pisciotta. Bottom row, left to right: Harold Townsend, Martha Cardenas, Duy Truong, Tori Duong , Aaron Lee.

The “Brewer Car” team used oral presentations, computer graphics and a battery-powered scale model to describe the technical requirements, environmental benefits and financial incentives that would ensure that their car would be ready to enter the consumer market.

The Edna Brewer team received high marks for their creativity, depth of research, sensitivity to environmental sustainability, and understanding of the broader economic concepts that underlie innovative transportation proposals. We have included a transcription of their entire presentation as Appendix A.

On Saturday, June 28, 2008, the Edna Brewer students, with their teacher Ms. Fay Pisciotta, were honored at the 2008 MTI Scholarship Awards Banquet on the campus of San José State University. During the event, the students commented on their experience, met with former U.S. Secretary of Transportation Norman Y. Mineta and Caltrans Director Will Kempton, and collected a $1000 prize and a plaque for their school.

Winning student team from Edna Brewer Middle School with Secretary Norman Mineta and teacher Fay Pisciotta at the MTI Awards Banquet, June 2008.

OPENING REMARKS

ROD DIRIDON
Executive Director, Mineta Transportation Institute

The Mineta Transportation Institute at San José State University in San José, California, is very happy to welcome you to the Eighth National Garrett Morgan Symposium on Sustainable Transportation. This videoconference is held each year for middle school and high school students across the nation.

The objective of this gathering is to encourage young people to pursue educational programs that will prepare them to become transportation professionals in their adult lives. The Mineta Transportation Institute, named in honor of former Secretary of Transportation Norman Y. Mineta, is proud to be once again sponsoring this event.

The Mineta Transportation Institute was created by Congressman Norman Mineta, who was then Chair of the U.S. House of Representative's Surface Transportation Infrastructure Committee, as part of the 1991 Intermodal Surface Transportation Efficiency Act. Our responsibility is to do studies in the area of transportation policy for Congress and for the California legislature, and to conduct educational programs to prepare the next generation of transportation managers for their professional careers.

Since 1991, research at MTI has focused on three themes: counterterrorism and security, transportation finance, and transportation planning and land use. We also have a graduate program leading to the degree of Masters of Science in Transportation Management taught through the College of Business at San José State University. The annual National Garrett Morgan videoconference is a uniquely rewarding part of our role in educating the transportation workforce of the 21st century.

Now let's take an electronic trip across the country to meet John Horsley, the Executive Director of the American Association of State Highway and Transportation Officials. John is a former Undersecretary of Transportation at the U.S. Department of Transportation and will be hosting the symposium site in Washington, D.C.

Joining him at that site is former U.S. Secretary of Transportation Norman Mineta and Vice Admiral Thomas Barrett, the Deputy Secretary of the U.S. Department of Transportation. I'll shift now to John Horsley, the immediate past chair of the Board of Trustees of the Mineta Transportation Institute.

JOHN HORSLEY
Executive Director, American Association of State Highway and Transportation Officials

I extend greetings from Washington, D.C. to the five student teams who will be participating in today's competition. We are sitting in the offices of the American Association of Railroads. The U.S. Department of Transportation, the state departments of transportation and the freight industries are all interested in bright young people who want to become part of the transportation workforce. We are looking forward to hearing your presentations today.

It is now my honor to introduce the individual for whom the Mineta Transportation Center was named, The Honorable Norman Y. Mineta. Norm began his political career as the mayor of San José, California. He was then elected to the U.S. Congress where he served with distinction for over 20 years, including an appointment as Chair of the Surface Transportation Infrastructure Committee for the U.S. House of Representatives.

He is one of the very few cabinet secretaries to have served in two different positions – as Secretary of Commerce for President Bill Clinton and Secretary of Transportation for President George H. Bush.

THE HONORABLE NORMAN Y. MINETA
Former Secretary, U.S. Department of Transportation

Thank you very much, John, for the gracious introduction and for your continued leadership at the Mineta Transportation Institute.

All of us are very proud of the Garrett A. Morgan Technology and Transportation Futures Program, initiated in 1997 by former U.S. Secretary of Transportation Rodney E. Slater. The program was developed because he believed that American children from all walks of life should have the skills for jobs in the 21st century. He was especially committed to attracting students to careers in transportation. It is due to Rodney's great leadership that we are broadcasting this symposium today.

Today's symposium will highlight the efforts of five groups of young people who are contemplating careers in transportation. In the future, they will have a wide range of career options including engineering, administration, public relations, planning, policy, environmental analysis, information technology and computer science.

The Garrett Morgan Symposium on Sustainable Technology, by design, involves middle school and high school students. This is the level at which young people must begin to commit themselves to courses in math and science to ensure that they are prepared for the transportation workforce of the future.

It is now my privilege to introduce our keynote speaker, Vice Admiral Thomas J. Barrett, the Deputy Secretary of the U.S. Department of Transportation. He is here today representing U.S. Secretary of Transportation Mary E. Peters, who was called away at a late hour.

I first knew Tom as a career officer in the U.S. Coast Guard. In 2002, when Tom was Vice Commandant of the U.S. Coast Guard, my wife and I had the opportunity to join Tom and his wife for Thanksgiving dinner on board a U.S. Coast Guard cutter about five miles off the coast of Cuba. When Tom ended his career with the Coast Guard after 35 years of service, he briefly entered the private sector.

But I knew Tom to be a hands-on person who was genuinely interested in the technical and operational aspects of how things worked. So in 2006, when I was the U.S. Secretary of Transportation, I called him back to government service to become the first Administrator of the new Pipeline and Hazardous Materials Safety Administration. When Mary E. Peters became U.S. Secretary of Transportation in 2007, she promoted Tom to the level of second-in-command.

Throughout his long career, Tom has shown what it means to devote your mind, your heart and your hands to public service. I hope that each of you will embrace his enthusiasm for the transportation profession. Please join me in welcoming Thomas J. Barrett, Deputy Secretary of the U.S. Department of Transportation.

VICE ADMIRAL THOMAS J. BARRETT
Deputy Secretary, U.S. Department of Transportation

Thank you very much, Norm. I'm delighted to be here with all of you today. I want to send greetings from my boss, U.S. Secretary of Transportation Mary E. Peters, who regretfully was called away at the last minute. It's a pleasure to be spending time with young people who are considering careers in transportation.

I'd like to begin by talking about history and innovation. This seminar is named for Garrett Augustus Morgan, a black American inventor who overcame a background of poverty and lack of formal education to forge a long and distinguished career.

His career included the invention of a gas mask that was later refined for use by U.S. soldiers during World War I, and the development of a pioneering traffic control device that is considered the forerunner of modern intelligent transportation systems.

As the story goes, Garrett Morgan watched an automobile collide with a horse-drawn carriage at an intersection in Cleveland, Ohio. Thinking about that accident prompted him to develop and patent the forerunner of today's modern traffic signals.

Prior to his invention, most traffic signs had two positions: stop and go. These two-position signals were an improvement over uncontrolled intersections but, because they allowed no interval between stop and go commands, collisions at crowded intersections were still common.

Garrett Morgan challenged the assumption that simple "stop and go" signals were enough to control busy intersections. He saw the consequences of relying on the system as it was and determined that he could do something better. He came up with the idea of a T-shaped pole that

featured three positions: stop, go, and an all-directional stop sign that let pedestrians cross busy streets. At night, or when traffic was minimal, the Morgan signal could be positioned in a half-mast position, alerting approaching motorists to proceed with caution through the intersection.

This technology was the basis of yellow "caution" light we have on modern traffic signals and was a significant contribution to what we now know as intelligent transportation systems. Garrett Morgan's simple innovation has saved thousands of lives since the 1920s because of his vision, spirit of innovation and willingness to tackle a problem that other people had ignored.

A lot of what we do today at the U.S. Department of Transportation is inspired by people like Garrett Morgan who are willing to challenge assumptions.

For example, we're now asking why there are no seat belts in school buses. We have laws that mandate drivers and passengers to buckle up each time they get into a car; laws that require safety restraint systems for infants and small children; and a proposal that children sit in booster seats until adult seat belts fit them correctly (typically between eight and 12 years of age).

Yet most school buses still have no seat belts. We think that this makes no sense and sends a conflicting signal to consumers. So we recently came out with the first federal standards for school bus safety restraints and districts around the country are now testing the concept.

We are also challenging the assumption that transportation congestion will get worse each year. We're looking at innovative ways to tackle this problem. One of these is public-private funding of new transportation infrastructure. We're also looking at congestion pricing, a way of more efficiently allocating the resources of the transportation system.

If you look at your cell phone bill, you'll likely see lower rates for calls made at night or on the weekends when phone traffic is lighter. We may need the same thing for roads so it's cheaper to travel during off-peak hours than during rush hours.

The same thing is true for aviation. Can we get airlines to schedule flights so we don't have the kinds of delays that ruined a lot of trips this past summer? We're looking at ways to use Global Positioning System (GPS) satellite technology in cars and aircraft to move vehicles through our system faster and more efficiently. Looking back at the work of Garrett Morgan, we're looking at technologies that would allow a traffic signal to stay green longer if there is traffic running in a certain direction, and lights that can send an audible signal to visually-impaired pedestrians so they can safely cross the street.

Secretary Peters has titled this initiative **"**Finding 21st Century Solutions to 21st Century Transportation Challenges." This is top priority for our department. There is no limit to what we can accomplish if we're willing to embrace innovation. Finding new answers for old problems is what energizes us at the U.S. Department of Transportation. I hope that this will energize you, too.

A lot of the industries that will support the transportation systems of the future will involve advanced technologies. This is where you will play a critical role. We need your technical skills and creativity to help us move forward.

Let me tell you more about what we do at the U.S. Department of Transportation. We have about 66,000 professionals. We make sure that we do everything we can to make people and cargo move safely across the country whether it's on the roads, on land, on rail, by air, by sea, by pipeline or by public transportation.

Safety is our first priority and always stays at the top of our work-list. We're now talking about sending private citizens into space. This is a very cutting-edge and experimental area, but if this takes place, the U.S. Department of Transportation will be there to ensure that these flights are as risk-free as possible.

President George W. Bush encourages students like you to study math and science. We really need that that skill set. Whether it's in areas related to engineering, construction, design, management, administration, planning, communications, energy, or environmental analysis, we need your hands, your hearts and your spirit of innovation to guide us to solutions to sustain the transportation system in the 21st century.

I'm thrilled that you're interested in transportation. A lot of people simply don't realize the impact that transportation has on our nation and on the viability of our communities. Nearly one in seven jobs in this country is tied to transportation in one form or another. The UPS package that arrives at your door may have come from across the world. It may have come on a ship, a train, a truck or a plane, but it has traveled from its point of manufacture directly to your door. Your package arrived because of the transportation system.

Transportation is fascinating. We are energized by your youth, enthusiasm and willingness to embrace innovation. Perhaps, at some future symposium hosted by MTI, you will be sitting in *our* chairs telling a future generation what you've learned, what you've brought forward and how you've improved the transportation system for our country. This competition is important, but it is only the first step on your own personal and professional journeys. I wish you well on both paths.

RON DIRIDON
Executive Director, Mineta Transportation Institute

Thank you very much, Vice Admiral Barrett. As a former naval officer who left the service as a lieutenant my hand automatically creeps up to my forehead in a salute whenever I hear the word 'Admiral' (salutes). [Vice Admiral Barrett returns the salute].

Let's proceed now with the introduction of another person who is also an "admiral" in our profession, a person whom John Horsley, Norm Mineta and I have known for most of our lives. He is a real superstar in the field of transportation and the current director of the California

Department of Transportation. He is also a member of the Mineta Transportation Institute's Board of Directors and a member of the Board of Directors of the American Association of State Highway and Transportation Officials.

This is Will Kempton, joining us from Caltrans headquarters in Sacramento, the capitol of the state of California. Director Kempton will introduce the participants today.

WILL KEMPTON
Director, California Department of Transportation

Thank you, Rod. It's a pleasure to once again be joining the Mineta Transportation Institute as we conduct this competition. It's always a very exciting event. This is the fourth or fifth one in which I've participated. I'm happy to say that California is the defending champion in this competition, but we'll see what happens today. It's always exciting to see young people and I think we'll all be learning a lot from them today.

I was not interested in or thinking about a job in transportation when I was a middle school student, which was many, many, many decades ago. But I did get my first job in transportation at Caltrans. I now head this department, which has 22,000 employees and a $13.9 billion annual budget. While we may not be as large as the U.S. Department of Transportation, we are the largest state department of transportation in the nation.

We seriously hope that many of you will want a job in transportation after you complete your education. It is a real challenge to build, operate, and maintain the bridges, highways and transit systems of this nation. You folks will be leading us into the future and helping us to build the transportation systems of tomorrow.

And who knows? There may be a future leader like Garrett Morgan among you today who will come up with innovative solutions to transportation problems. You now know more, after your effort here with the Garrett Morgan symposium, than most adults do about sustainable transportation and I look forward to hearing all of these presentations.

We have five schools across America. We have three from California, one from Maryland and one from Virginia. Let me start by introducing the Leonardtown High School ninth graders from Leonardtown, Maryland. Their teacher is Barbara Musser. This school is sponsored by Tate Jackson of AASHTO. We also have the School of International Studies at Meadowbrook sixth graders from Norfolk, Virginia. Their teachers are Ebony Elijah and Jeanina Harris. This school is sponsored by Michael Townes and Tamara Poulson from the Hampton Roads Transit Agency.

Moving back across the country we have the Edna Brewer Middle School eighth graders from Oakland, California. Their teacher is Fay Pisciotta. The school is sponsored by Alfonso Miles from Caltrans. Then we have the George Flamson Middle School eighth graders from Paso Robles, California. Their teacher is Ayen Johnson. Their sponsors are Julia Bolger and Janet Newland from Caltrans. Finally, we have the MacArthur Fundamental Intermediate School

eighth graders from Santa Ana, California. Teachers are Emily Fellmer and Kevin Black. Their sponsor is Norma Quezada from Caltrans.

Congratulations to all the schools and thank you very much for your outstanding efforts. We hope that this symposium will encourage you to consider a career in transportation. Stay with that math and science. We need folks like you to help us lead the way into the future of this great country. I wish you all luck in this competition. Now, Rod, on with the show!

STUDENT PRESENTATIONS

ROD DIRIDON: We'll now begin the part of the symposium in which each student team presents their proposal for a sustainable transportation innovation. As you all know, each school will have ten minutes for their formal presentation. Then, we will proceed to a two-part question and answer session that will involve the student teams and our transportation experts.

Let me now introduce Donna Maurillo, Director of Special Projects and Communications for the Mineta Transportation Institute, who will be moderating the remainder of today's activities.

Donna has a background in marketing, communications and public relations. Her clients have ranged from high-technology firms to grass-roots community organizations. Donna is currently pursuing the degree of Master's of Science in Transportation Management through San José State University's School of Business in addition to her full-time job at MTI.

I know that her organizational skills, energy and enthusiasm for transportation education will add a great deal to today's proceedings. Please join me in welcoming Donna Maurillo.

DONNA MAURILLO: Thanks very much, Rod. It's really a pleasure to be here today. I will explain a little bit about what we're doing today and then we'll begin the program.

The schools would normally be presenting in alphabetical order but the School of International Studies at Meadowbrook has a time constraint due to their school bus schedule, so they will be the first school to present today. Here is the line-up for today's competition:

- School of International Studies from Norfolk, Virginia, broadcasting from the Vicom site in Virginia Beach, Virginia.
- Edna Brewer Middle School from Oakland, California, broadcasting from the Caltrans District 4 site in Oakland, California.
- George Flamson Middle School from Paso Robles, California, broadcasting from the Caltrans District 5 site in Paso Robles, California.
- Leonardtown High School from Leonardtown, Maryland, broadcasting from the Association of American Railroads site in Washington, D.C.
- MacArthur Fundamental Intermediate School from Santa Ana, California, broadcasting from the Caltrans District 12 site in Irvine, California.

The student teams will be evaluated on a wide range of measures. We will, of course, be judging them on the technical aspects of their proposal including innovation, quality of scientific research, commitment to sustainability and potential for real-world implementation. But in addition to these technical criteria, we will also be evaluating each student team on the quality of their interaction as a group, the professionalism of their presentation and the nature of their participation in the two question and answer sessions. A perfect score is 150 points.

The winning school will receive $1000 and will have expenses paid for their teacher, one of the students from their project team, and a parent (or, if they prefer, another student) for a trip to San

José, California, on Saturday, June 28, 2008, to participate in the graduation ceremony for students from MTI's 2008 Master's of Science Program in Transportation Management. This event attracts transportation dignitaries from all over the country and is an excellent opportunity for the students to interact with current transportation leaders.

Now we will begin the formal presentations by student teams with the School of International Studies at Meadowbrook from Norfolk, Virginia, broadcasting from the Vicom site in Virginia Beach, Virginia.

SCHOOL OF INTERNATIONAL STUDIES AT MEADOWBROOK, SIXTH GRADE

Magnetic Hover Bus

Teachers: Jeanina Harris and Ebony Elijah

Sponsor(s): Hampton Roads Transit Agency, Michael Townes, President/CEO and Tamara Poulson, Community Relations Specialist

The School of International Studies at Meadowbrook used computer graphics and a scale model to propose the *Magnetic Hover Bus (MHB)*, a mass transportation system that can operate on both land and water using totally renewable energy sources.

The Magnetic Hover Bus is powered by magnetic levitation. Magnets mounted on the bottom of the vehicle and on the system's fixed track can be polarized to repel each other and levitate the bus. On the water portion of the route, the magnetic strips will be embedded underwater so the MHB appears to be floating above the water. After the MHB has completed its water route, the magnetic strip will connect to magnetic tracks on land and the MHB will continue its route. The MHB will be moved forward by propellers.

The cost of the MHB would be approximately $1.5 billion for infrastructure construction and $20,000 - $30,000 for each additional car. The cost of the cars could be reduced by mass production.

The MHB has a number of benefits. Magnetic levitation is quiet so the MHB will not disturb residents adjacent to its route. Because magnetic levitation produces little or no waste products, it is a non-polluting energy source. The MHB is also an efficient mass transportation mode. The system can transport about fifty people per car and can quickly accelerate from 0 MPH to 300 MPH. This allows a large number of people to be quickly transported over relatively long distances with minimal damage to the environment.

But the MHB also has some disadvantages. If a lightning storm hits, the MHB could be severely damaged or destroyed because magnets attract lightning. An extremely high tide could damage or destroy the MHB during the water portion of its route. However, this event could be avoided by further elevating the MHB above the surface of the water during high-risk periods. The magnetic forces of the MHB could also impact the biological ecosystem of the bodies of water

that it traverses. This calls for constant monitoring, management, and control of the magnetic fields.

The team also addressed passenger safety concerns, noting that their buses have safety rails and a safety technician on-board to monitor operations and watch for possible situations that would cause problems. The team concluded its presentation with a demonstration of a scale-model of the MHB, showing how the bus can travel over water and land.

EDNA BREWER MIDDLE SCHOOL, EIGHTH GRADE

The Ina Zuma Plug-In Biodiesel Hybrid Car

Teacher: Fay Pisciotta

Sponsor: Caltrans District 4, Alfonso Miles, Associate Caltrans Administrator

Students from the Edna Brewer Middle School organized themselves as a corporate team, "Brewer Cars," to propose the *Ina Zuma Plug-In Biodiesel Hybrid Car*. [In martial arts, Ina Zuma means "lightening flash."] This zero-emission car runs on electric, biodiesel and solar power. With additional financial incentives, the Brewer Car plan can reduce home energy costs, curtail transportation emissions and global warming, and reduce our reliance on fossil fuels.

The "Brewer Car" team used oral presentations, computer graphics and a battery-powered scale model to describe the technical features, marketing considerations and financial incentives that would make their car ready for the consumer market.

The team began by describing the environmental benefits of their car. The United States emits more greenhouse gases than any country in the world. The Ina Zuma car was created to reverse this trend and reduce our dependence on fossil fuels.

As a plug-in hybrid, the Ina Zuma is different from other hybrid cars because it can be recharged from the home and has a longer range. In addition, when the car is not being used, the electricity can be stored in the batteries to provide electric power to the home.

To gauge the potential market for hybrid vehicles, the Brewer team created a survey that asked adults why they had not yet bought a hybrid car. They found that the major factor was the higher cost of the hybrid vehicle. So the team sought a way to make the Ina Zuma more affordable for consumers.

Their idea was to give a free home solar panel to every buyer of the Ina Zuma car. This would result in a savings of $10,000 - $15,000 for each household. These savings can then be applied to the purchase price of the Ina Zuma. The team showed a scale model of a solar-powered house equipped for the Ina Zuma and described how the car could be plugged in to generate power for lights and fans in the house, and for the car itself.

To test the ability of solar power to run the Ina Zuma, the Brewer team bought a small solar battery for their scale-model car. They ran the car until the battery was depleted, put the battery

outside in the sun and recharged it with solar energy. Once recharged, the battery was once again able to run the car.

The team then turned to the biodiesel component of their car. Biodiesel is a renewable fuel that generates about 78% fewer pollutants and greenhouse gases than fossil fuels. Biodiesel and diesel fuels now cost about the same, but the Brewer team predicted that the cost of diesel will go up while the cost of biodiesel will go down as consumers adopt their product.

One of the major innovations proposed by the Brewer Car team was the use of algae as the primary source of biodiesel fuel. Today, most biodiesel fuel is produced from corn. Corn can take a whole season to grow. It is also the staple of the diet of many people around the world. Algae are a totally renewable environmentally-friendly resource that can be grown very quickly in large plastic bags filled with water.

To further encourage consumers to buy the Ina Zuma, the team proposed two new laws, called "Harold's Laws" in honor of the team's legal representative, Harold Townsend.

The first law would require every gas station in America to have solar panels on their roofs by the year 2018. This law takes advantage of the large flat areas occupied by gas stations. When gas stations generate electricity from solar panels, they can fuel a large fleet of zero-emission vehicles and also provide surplus power to electric utilities.

The second law would provide a free roof-mounted solar panel to each household that buys an Ina Zuma car. This will allow these households to power their car on a completely renewable energy source for trips up to 50 miles. Car conversion kits that allow consumers to convert their existing cars into electric vehicles could also be offered.

In conclusion, the Brewer Car team urged consumers to buy their car to reduce greenhouse gases, preserve environmental resources and save money on gasoline and household energy bills.

GEORGE FLAMSON MIDDLE SCHOOL, Eighth Grade

Applications of the Stirling Engine

Teacher: Ayen Johnson

Sponsor(s): Caltrans District 5, Julia Bolger, Resource Manager and Janet Newland, Web Coordinator

The George Flamson Middle School began its presentation by arguing that the world is almost totally dependent on petroleum fuels. These fuels are rapidly being depleted, are rising in cost and contribute to global warming. The goal of their project was to propose a renewable transportation energy source that relies on existing materials and technologies and can slow down the consumption of fossil fuels and the production of greenhouse gases.

Their solution is the *Stirling Engine*, invented and patented by Dr. Robert Stirling, a Scottish minister, in 1816. The Stirling Engine is a closed-cycle regenerative heat engine with a gaseous working fluid. The engine consists of a heating element and a cooling element, both of which can be powered by solar power.

The team then described the technical elements of the Stirling Engine. Stirling Engines have two pistons per gas chamber. The larger piston is smaller than its cylinder so that gas or liquid can travel through the hot and cold sections of the piston. The smaller piston is very tight fitting and moves up as the substance expands. When one side gets heated the substance expands. The expansion pushes the piston up into the cooled area. In the cooled area, the particles are closer together and will resist getting squeezed and push back, compressing the hot substance again and completing the cycle. The two pistons turn a shaft that is connected to the drive shaft that drives the wheels directly and/or to a small generator to more quickly provide power.

The Stirling Engine has many benefits. It consumes no fossil fuels and produces no greenhouse gases. The engine has very low operating costs because there is no need to add external fuel. The engine requires only simple maintenance and is very quiet. Engines can be small, giving more room in the vehicle for passengers and cargo. Each engine would cost approximately $1,000 to produce. This cost varies based on the size of the engine and the number of pistons. Very small hand-held models cost about $200. Larger models can cost about $1,000 per piston or $5,000 for a very large engine.

The whole device can be made of light metals like aluminum or out of steel and only require a few large parts. The smaller components are inexpensive parts like rubber stoppers. The engine can use any kind of gas or liquid that expands and contracts. Most of the major parts required for the Stirling Engine are already in production. All we need to do is retrofit assembly plants to produce these engines.

The students concluded by noting that the Stirling Engine does have one major drawback. Heat exchange is a time-consuming process, so starting the engine could take some time. A potential solution is creating a hybrid engine with an electric or gas motor to provide immediate changes in power output.

LEONARDTOWN HIGH SCHOOL, Ninth Grade

Solar-Hydropower Bus

Teacher: Barbara Musser

Sponsor: American Association of State Highway and Transportation Officials, Tate Jackson, Coordinator, Transportation and Civil Engineering (TRAC) Program

Leonardtown High School made an oral presentation supplemented by computer graphics to propose the *Solar-Hydropower Bus*, a vehicle that can provide inexpensive totally-sustainable mass transportation using a combination of solar and hydroelectric power. The presentation was

notable for its consideration of differences in regional climates that may influence the operation of the bus.

The team began with a description of their proposed vehicle. The bus will have solar panels on its roof to collect solar energy during daylight hours as the bus moves. This energy will be used to turn turbines in the bus. This will produce electricity to propel the vehicle.

When it rains, the windshield wipers will push water into collection ducts along the hood and into tanks located inside the bus. The hydroelectric power system can also draw moisture from the air and from radiators inside of the front of the bus. With pressure, this water will turn turbines to provide electric power for the bus.

The Leonardtown team directly addressed several technical issues associated with their solar-hydroelectric power bus. The major problem associated with solar power is that not every day is a sunny day. Similarly, hydroelectric turbines need a constant source of water from rain and in many geographic areas the amount of rain is limited. Hydroelectric turbines also need a lot of pressure and energy to operate and take a long time to power up. Until the hydroelectric turbines are fully charged, you still need to rely on solar power.

The Leonardtown team proposed an innovative solution to these problems. This is a switch mounted inside the bus that can immediately change the power source from solar to hydroelectric. The switch has two options: "up" for solar power and "down" for hydroelectric power.

If the weather is cloudy and solar power is not an option, the bus can be switched to hydroelectric power. Conversely, in case of a dry spell when there is no rain on the horizon, the bus can be switched to solar power. As an additional solution to long periods without rain, water tanks inside the bus can be manually filled with water to power the bus. Because hydropower takes some to start, there will be a battery in the front of the bus that stores leftover energy from the solar panels that will give the hydroelectric turbine the needed jump-start to operate the vehicle.

The proposed solar-hydropower bus has many advantages. First, there will no longer be any need to refuel the buses with costly diesel fuel. The only capital cost to put these vehicles into service is for the parts needed to make the bus solar and hydroelectric powered. The cost for passenger fares could also be reduced because the passengers' fares will no longer reflect the cost of diesel fuel.

The team concluded their oral presentation with three slides. The first slide illustrated the major component parts of their bus, the second slide showed alternative configurations for water turbines and the last slide listed reference sources consulted for their project.

MAC ARTHUR FUNDAMENTAL INTERMEDIATE SCHOOL, Eighth Grade

Electric/Solar/Windmill Powered Car

Teachers: Emily Fellmer and Kevin Black

Sponsor: Caltrans District 12, Norma Quezada, Recruitment Officer

Mac Arthur Fundamental Intermediate School proposed a car powered by a trio of sustainable fuels: electric power, windmill power and solar power. The team began by noting that each of these energy sources has strengths and weaknesses. But in combination, these sources could lead to the sustainable car of the future.

Electric cars reduce our dependence on petroleum fuels and produce few harmful emissions. But the driving range of electric vehicles is limited and there are very few commercial charging stations. Solar panels can charge a battery by collecting energy from the sun, an abundant and renewable energy source. But solar energy can't be collected on cloudy days or at night. This is why they also included windmills on their vehicle.

They argued that integrating all three sustainable sources into one vehicle could go a long way toward reducing our dependence on petroleum, reducing emissions and greenhouse gases and slowing global warming. Then, they turned to a review of the pros and cons of each of their three energy sources.

Electric vehicles use chemical energy stored in rechargeable battery packs, electric motors and motor controllers. Electric vehicles were one of the earliest types of automobiles proposed in this country. But they were soon replaced by internal combustion engines. Electric vehicles have become popular again. Electric vehicles produce low levels of toxic emissions, can exceed the average speed of other vehicles, are extremely quiet, can lessen our dependence on petroleum fuels, and can reduce greenhouse gases and global warming.

Though the electric car has many benefits, there are still some problems. The battery contains acids and other chemicals that can harm our environment. There are very few electric vehicle charging stations available to consumers. Another major disadvantage is the limited range of electric vehicles. What happens when the electric battery is not sufficiently charged to complete your trip when you are still on the road?

This is why the Mac Arthur team added windmills to their car. Windmills or wind turbines can generate up to 6 million watts of power and are now being used to provide energy in many areas of the world. Wind energy is clean, renewable and practical.

For their car, the student team chose to position the windmills at a 90 degree angle underneath the car to capture the maximum amount of wind and minimize the amount of external damage to the blades. Even with their advantages, windmills may still pose a hazard to wildlife, especially birds. To minimize this risk, the team proposed a special protective shield to help prevent bird strikes.

What happens if there is no wind? That's where solar energy takes over. In solar energy systems, rays of the sun contact solar panels and are absorbed by semiconducting materials that, in turn, produce electricity that can be stored in the car's battery. Even when there is no sunlight, there will be enough stored energy to help power the car.

Solar panels have no fuel costs, are silent and do not produce harmful fumes that contribute to global warming. Unfortunately, solar panels won't work on cloudy days or at night and are relatively expensive due to the special materials required for their production.

Ironically, the tri-fuel vehicle could lead to the overcharging of its battery. To prevent this, the students proposed an indicator inside the vehicle that would notify the driver if the battery is currently charging or fully charged. When the battery is fully charged, there will be an automatic shut-off mechanism so there will be no need for the driver to do it manually.

The team concluded that their proposed vehicle will benefit the environment for many years to come. Each of the energy sources in the vehicle has its advantages and weaknesses. But combined, their potential to create the car of the future is unlimited.

QUESTIONS AND ANSWERS

This portion of the symposium was conducted in two parts. In the first part, students questioned other students about technical and safety issues related to their proposals. In the second part, students questioned transportation experts about how to prepare for transportation careers and what challenges they may face as they enter the transportation workforce of the 21st century. Each school was asked to prepare at least one question for the transportation dignitaries.

STUDENTS QUESTION STUDENTS

Question from School of International Studies at Meadowbrook: This question is for the Edna Brewer Middle School. What would be the cost to produce your plug-in biodiesel hybrid car?

Edna Brewer Middle School Answers: It would cost about the same as a conventional car.

Question from Edna Brewer Middle School: This question is for the MacArthur Fundamental Intermediate School about their electric/solar/windmill powered car. What if you were on the freeway on a cloudy day and there was no sun or wind and your vehicle ran out of electricity? How would be able to still run your car?

Mac Arthur Fundamental Middle School Answers: Our car will have a back-up battery.

Question from Edna Brewer Middle School: We also have a question for the MacArthur Fundamental Middle School team. Would the size of the wind turbine on your car make it difficult to drive alongside other vehicles on the road?

Mac Arthur Fundamental Middle School Answers: The turbine is sized to fit underneath the car so it won't interfere with other vehicles on the road.

Question from George Flamson Middle School: This is a question for the School of International Studies at Meadowbrook about their magnetic hover bus. Maglev technologies are already under heavy research. How does your proposal differ from others?

School of International Studies at Meadowbrook Answers: Our proposal is different because our vehicle is designed to travel for short distances on both land and water. Other proposals have only dealt with high-speed travel on land. Also, our bus may cost less to build.

Question from George Flamson Middle School: We'd like to ask the Edna Brewer Middle School about their plug-in biodiesel hybrid car. Biodiesel is already available today. Why isn't it more popular?

Edna Brewer Middle School Answers: Biodiesel is not yet widely produced and there is currently no plug-in biodiesel hybrid car on the market. Our proposed laws would make this idea

more popular. Since more people would want to buy biodiesel fuel, more companies will start producing it, and biodiesel fuels would be available in regular fueling stations.

Question from Mac Arthur Fundamental Intermediate School: We would like to ask the School of International Studies at Meadowbrook about their magnetic hover bus. How safe is it? It sounds like an electrical death trap!

School of International Studies at Meadowbrook Answers: The magnetic hover bus will not be operated during lightening storms and we will have safety technicians on board in case of any technical difficulties. We will also have another safety technician who will monitor and control the magnetic fields to make sure that the vehicle won't be affected by high tides or electrical activity.

Question from Edna Brewer Middle School: Our question is also for the School of International Studies at Meadowbrook. How will your hover bus turn corners?

School of International Studies at Meadowbrook Answers: Our hover bus follows a fixed guideway. It is guided by magnets that are on the guideway and underneath the bus. By adjusting the magnets, we can make the bus turn left or right and still stay on track.

Question from School of International Studies at Meadowbrook: We have a question for Leonardtown High School about their solar-hydropower bus. We have a lot of tunnels in our area. How would your bus operate in tunnels where there is no solar power?

Leonardtown High School Answers: Our bus can operate in tunnels because it has a switch to make the vehicle run on hydropower. When you go into a tunnel, you switch to the hydropower mode to start the hydropower turbines so that no solar energy is needed.

Question from Leonardtown High School: We have a question for the School of International Studies at Meadowbrook about your magnetic hovering bus. You say that you would stop running your bus if there is a thunderstorm, but what happens to the passengers who still need to get to their destination? What do they do?

School of International Studies at Meadowbrook Answers: They can use the other transportation services in our area such as our Hampton Roads Transit buses and trolleys. But our plan also calls for an option in which passengers can get off the rail track by a ladder that will guide them to safety.

Question from School of International Studies at Meadowbrook: This question is for the Edna Brewer Middle School about their plug-in biodiesel hybrid car. Wouldn't your car actually cause more traffic congestion in your area because everyone would want to buy your car?

Edna Brewer Middle School Answers: No. There won't be more congestion than there is now because people can't drive two cars at once.

STUDENTS QUESTION THE EXPERTS

Question from George Flamson Middle School: Out of curiosity, how many people have heard of the Stirling engine?

Michael Townes, President/ CEO of Hampton Roads Transit Agency: Didn't Governor Schwarzenegger have one installed in his Hummer? [Laughter.] I believe that it's an engine that generates more power by re-burning exhaust, similar to what a high-performance jet does with an afterburner.

George Flamson Middle School Responds: Yes, there are different versions of the Stirling engine, including one that can recycle its own power using a regenerator. Technically, the Stirling engine doesn't use any fuel whatsoever. All you need is a heater and a cooler that can be powered by solar power. You can buy small versions of it on the Internet that can be powered by the difference between the heat of your hand and the air.

Question from Mac Arthur Fundamental Intermediate School: What educational route should we pursue to become an environmental planner?

Will Kempton, Director, California Department of Transportation: Environmental planning, like engineering, requires a lot of math and science. Both careers require a Bachelor's of Science degree. Governor Schwarzenegger is looking at initiatives that will increase the number of new engineering graduates in California by 20,000 in the next few years. If you're looking for a good career in transportation, either in environmental science or engineering, we want you at Caltrans.

Question from School of International Studies at Meadowbrook: What type of classes should we take to work in the transportation field?

Will Kempton: It varies, depending on the field that you want to get into. Obviously, if you're looking to get into transportation engineering, math and science are critical. You have to start taking math and science at your grade level to qualify to go on to college as an engineering student. Other careers in transportation, like environmental planning, administration and communications require courses in other fields, but math and science are important as well. Transportation is a very broad field and we need people with a variety of educational backgrounds.

Monica Wilson, Caltrans District 4: I'd like to add something as well. I'm Monica Wilson, Chief of the Office of External Services at Caltrans District 4. My responsibilities include EEO/ Recruitment. I'm here today to encourage California students to look at transportation as a career option and consider working for Caltrans as a student assistant once you enter college. The general criteria for a student assistant are credit for six semester units or nine-quarter units in a college or university that has a Caltrans-qualified internship program. Student assistants receive an hourly wage, vacation, sick leave and retirement benefits. We also have a youth aide program that involves high school students. Both of these programs provide a great opportunity learn

about the California Department of Transportation and see if this is where you want to work in the future. We would love to have you.

Question from George Flamson Middle School: What daily responsibilities would we have if we accepted these positions?

Monica Wilson: Student assistants and aides can work in various areas within Caltrans including engineering, construction, administration, planning, right-of-way and maintenance. We also have an architecture program if there are any budding architects among you.

Question from Edna Brewer Middle School: What is the minimum age to participate in these programs?

Monica Wilson: To participate in the student assistant program, you must be a high school graduate, have a certificate of completion signed by your high school and an additional form signed by a parent if you are under 18 years of age. The youth aide program is a little bit different. Most of the students that I've employed in Sacramento have been at least 14 years old.

Question from George Flamson Middle School: What does a transportation worker typically do in a day?

Will Kempton: Again, it depends on what you're doing. If you are a transportation engineer, you might be doing design work on the Bay Bridge, inspecting the work of an existing contractor, or testing the materials used on a new construction project. If you are a planner, you might be doing environmental analysis or working with local agencies to determine the best location for a transportation facility. If you are a right-of-way agent, you might be working to negotiate the purchase of property and working with the public to buy the land that we need to expand our transportation facilities. Our maintenance workers are out taking of the roadways, removing debris or perhaps clearing snow. If you like working outdoors, this may be a good choice for you.

Donna Maurillo, Mineta Transportation Institute: I'd like to also point out that there are many administrative positions, as well. I work in marketing. Throughout my career, I've been involved in land use issues and found that it was very important to have good community relations because sometimes you're going to be constructing a road near somebody's neighborhood, so you need to make sure that they have all the information they need. They need to know how long it's going to take, they need to know if they're going to be inconvenienced, and they need to know the benefits of having an improved roadway. There has to be somebody who knows how to communicate with them.

We also need people who can deal with city councils and boards of supervisors in order to get those projects accepted by a community. There are lots of jobs in transportation for communicators, writers and people who want to get into marketing. Just about anything that you could think of doing for a business or a public agency can be done in the transportation field. Managing a transportation system is like managing a business; the system has to operate efficiently.

Question from School of International Studies at Meadowbrook: Why do we have so many different transportation modes? Shouldn't we just use the one that is the most sustainable and best for the ecosystem?

Michael Townes: In America and throughout the world, people need choice. One system is not going to solve everyone's needs. I work in public transportation. It's very important that we provide public transportation so that people have the choice not to use a private automobile. But it's also important to have systems like Will Kempton and his counterparts build so that we can have private automobiles going to and from places in a flexible manner.

It's also important that we have freight trains and trucks to deliver goods. These goods are not going to get to homes or stores by public transportation. If you want to go across the continent or from continent to continent you need airplanes. It takes multiple systems to provide for the welfare of all the people on the earth. Obviously we want to do that in a way that has the least impact on the ecosystem. That's where you young people are going to come in. You have a chance to make sure that all transportation modes are more efficient and sustainable.

Question from George Flamson Middle School: With the new models of hybrid cars coming into the market, won't that add more congestion on the roads because people will want to own and drive hybrid cars but still keep driving their older ones, too?

Will Kempton: Congestion is a growing problem, especially in California. Congestion is going to increase as long as we continue to depend on the private automobile for almost all of our travel. As Michael Townes said, we need multiple systems in our transportation network. Certainly, we need to be looking at rail options. Here in California, we have three inter-city rail services. One of them, the Pacific Surfliner, goes all the way from San Luis Obispo to San Diego. Local and regional public transit systems are also vital and we must continue to provide that option. Alternative modes are needed to move this state and this country into the future.

CLOSING REMARKS BY RON DIRIDON

This concludes the formal portion of today's symposium. We have carefully evaluated your presentations and questions and answers according to the criteria that have been provided to you. Our judges will now review these evaluations. We will come to a conclusion and let you know within the next week which of the students, teachers and parents will be coming to the MTI scholarship ceremony on June 28, 2008, in San José.

We appreciate the comments and support of our dignitaries, Norman Y. Mineta, former Secretary of the U.S. Department of Transportation; Vice Admiral Thomas J. Barrett, Deputy Secretary of the U.S. Department of Transportation; John Horsley, Executive Director of the American Association of State Highway and Transportation Officials; and Will Kempton, Director of the California Department of Transportation.

We extend special appreciation to all the teachers who encouraged their students to participate in the Garrett A. Morgan Technology and Futures Program. We know that it takes time and effort to incorporate this lesson plan, which does meet state and federal criteria as a science class, into your existing teaching schedules.

We also thank the coordinators at each of the sites. We especially thank Michael Townes, who, in addition to his responsibility as President/CEO of the Hampton Roads Transit Agency is currently serving as Chair of the American Public Transit Association. We know that this symposium has taken a great deal of time out of his day and appreciate his willingness to participate throughout the entire program. We are already preparing for the 2009 Garrett Morgan Symposium and will be back with many of you again next year.

We have thoroughly enjoyed this time with our 2008 student competitors. We know that a great many of you will be running federal, state and local transportation agencies when it is your time to assume leadership roles. So prepare well, take those math and science courses in high school, go on to college and get a good degree. Then, go out there and run the transportation systems of the future! The Eighth National Garrett Morgan Symposium on Sustainable Transportation is now officially adjourned.

Appendix A:

WINNING STUDENT PRESENTATION

The Ina Zuma Plug-In Biodiesel Car

A presentation by Brewer Cars

Corporate Headquarters:

Edna Brewer Middle School

Oakland, California

Corporate Officers:

Duy Truong, Chief Executive Officer

Tori Duong, Marketing Director

Aaron Lee, Plug-In Hybrid Research Manager

Martha Cardenas, Biodiesel Research Director

Harold Townsend, Legal Representative

MR. TRUONG: Good morning. My name is Duy Truong and I am the Chief Executive Officer of Brewer Cars. We're here today to talk to you about our amazing product, the Ina Zuma plug in-biodiesel hybrid car.

Have you ever wanted to stop climate change? Here's a way that you can help. You can buy our product, the Ina Zuma. Our car is a form of sustainable transportation that uses renewable energy sources and offers many environmental benefits over conventional vehicles.

The United States emits more greenhouse gases than any country in the world. If the U.S. adopted the Ina Zuma we could significantly reduce greenhouse gases. We have also created a set of laws created by our Legal Representative Harold Townsend. "Harold's Laws" create financial incentives to encourage consumers to buy and use our car.

Now Tori Duong, our Director of Marketing, will tell you we why we created the Ina Zuma.

MS. DUONG: Thank you, Duy. We created the Ina Zuma car to help reduce global warming caused by greenhouse gases. Greenhouse gases are pollutants in the air that trap heat in our atmosphere. About 14% of greenhouse gases are created by transportation emissions.

If people would adopt the Ina Zuma car, these greenhouse emissions would almost be eliminated. Harold's Laws, which he will discuss later, will also help reduce emissions from residential and commercial sources, which contribute to 10.3% of greenhouse gases.

Overall, the entire Ina Zuma project lowers our dependence on fossil fuels. This, in turn, will lower greenhouse gas emissions generated by harvesting fossil fuels and by powering electrical stations that rely on fossil fuels. Our entire project will significantly reduce greenhouse gases and reduce global warming.

Now, Aaron Lee, our Plug-in Hybrid Research Manager will explain the advantages of plug-in solar power.

MR. LEE: Thank you, Tori. As part of our research, our class developed a survey that asked adults why they haven't yet bought a hybrid car. Our results showed that the main reason was the hybrid's higher cost. Because of this, we knew that we needed to make our car more affordable for consumers.

If you buy an Ina Zuma, you can practically toss away your household electric bill. This is because when you buy our car you will also get a free solar panel for your home. These panels typically cost between $10,000 and $15,000 each. To buy our car, you can apply your savings from the free solar panel toward the cost of the car. So when you buy our car you'll be both saving money and getting money.

Since our car runs on electricity from solar panels, it emits zero emissions. The solar panels will not just power your car; they will also power your house. Here is a scale-model of a house equipped for the Ina Zuma. Solar panels on the roof of your house can power both lights and fans inside your home. To recharge your car, you simply plug it into the area in your home that says "plug in electricity." To refill your tank with biodiesel, you can go to any local gas station that provides biodiesel fuel.

To test the ability of solar power to run the Ina Zuma, our class purchased a solar battery charger for our scale-model car. We used up all the power in the batteries in the car, then we put the batteries in the solar charger and left the solar panel out in the sun to recharge the batteries. Then we put them back in the car and the car once again ran on power from the batteries.

As a plug-in hybrid, the Ina Zuma is different from other hybrid cars because it can be recharged from the home and has a longer range. In addition, when the car is not being used, the electricity can be stored in the batteries. In case of an electrical blackout in your area, the electricity stored in the car's battery can be used to power your house.

Now Martha Cardenas, our Biodiesel Research Director, will explain our idea for a unique source of biodiesel fuel.

MS. CARDENAS: Thank you, Aaron. Biodiesel is a renewable fuel that does not generate as many pollutants and greenhouse gases as gasoline. You can make biodiesel from many organic sources such as animal fat, vegetable oil, and algae.

To make biodiesel you have to go through a process called trans-esterification. This process separates the oil and fat from the other organic components, yielding pure biodiesel fuel. Trans-esterification also generates a byproduct called glycerin that can be used to make soap and many other things.

Biodiesel is better than regular gasoline because it doesn't contribute as many pollutants that cause global warming. In fact, biodiesel creates 78% less emissions than conventional fuels.

Biodiesel and regular diesel fuels now cost about the same. But we predict that, in the near future, the cost of regular diesel fuel will go up but the cost of biodiesel will go down. Biodiesel also has other advantages. It doesn't cause as much mechanical wear on the car's engine as conventional fuels and doesn't cause emissions that can contribute to asthma.

One of our major innovations for the Ina Zuma car is to propose algae as the primary source of biodiesel fuel. Today, most biodiesel fuel is produced from corn. Corn can take a whole season or more to grow and to be harvested and processed. It is also a staple of the diet of many people around the world.

Our solution to this problem is to use algae as our biodiesel source. Algae are a totally renewable resource that can be grown very quickly in large plastic bags filled with water. Algae-based biodiesel is better for the environment and for our cars to use. It truly is the fuel of the future.

Now Harold Townsend, our Legal Representative, will describe "Harold's Laws," two laws designed to encourage people to buy our Ina Zuma car.

MR. TOWNSEND: Thank you, Martha. To encourage people to buy the Ina Zuma, we have proposed two new laws.

The first law would require every gas station in America to have solar panels on their roofs by the year 2018. This law takes advantage of the large flat areas occupied by gas stations. When gas stations generate electricity from solar panels, they can fuel a large fleet of zero-emission vehicles and provide surplus power to electric utilities.

This law proposes that the gas stations pay for half of the cost of the solar panels and that the government pays for the other half through gasoline taxes. The gas stations would immediately benefit by selling excess energy to electric utilities. Over time, their financial burden will become less as consumer demand lowers the price of solar panels.

The second law would provide a free roof-mounted solar panel to each household that buys an Ina Zuma car. This will allow these households to power their Ina Zuma car on completely renewable energy. The Ina Zuma will be able to travel for about 50 miles on a single solar charge. This initiative would be partly paid for by the petroleum industry and partly by a tax on the car companies who do not sell our product.

We could also sell car conversion kits that allow consumers to convert their cars into electric vehicles. Together, these initiatives can help the world by reducing greenhouse gases and reducing our dependence on petroleum.

MR. TRUONG: Thanks to the entire team for their presentations today. The Ina Zuma car is an exciting way for consumers to reduce greenhouse gases, preserve environmental resources and save money on gasoline and household energy bills. We hope that the Ina Zuma will soon be on highways everywhere.

Appendix B:

GARRETT AUGUSTUS MORGAN, 1877-1963

Garrett Augustus Morgan, for whom the U.S. Department of Transportation Technology and Transportation Futures Program is named, was born in Paris, Kentucky, in 1877. The seventh of 11 children, his parents were former slaves. Although his formal education ended at the sixth grade, Garrett Morgan went on to become a world-famous inventor and entrepreneur.

Despite his humble beginnings and lack of formal education, Mr. Morgan made an impact on the course of human events. Shortly after his death in 1963, Morgan was awarded a citation by the U.S. government for his significant inventions.

Notably, in 1923, Mr. Morgan invented and patented a successful early traffic signal. It was during this time that the automobile was becoming common, sharing the nation's streets with bicycles, horse-drawn vehicles and pedestrians. Collisions were frequent and often bloody. After witnessing such an accident in Cleveland, Ohio, Mr. Morgan decided to invent a device to make the flow of traffic safer. The Morgan traffic signal was a T-shaped pole topped with three illuminated signs: stop, go and an all-directional stop that let pedestrians cross the busy street. At night, or when traffic was minimal, the Morgan signal could be positioned in a half-mast posture, alerting approaching motorists to proceed through the intersection with caution. This technology was the basis of the modern-day traffic signal and was a significant contribution to what we now know as Intelligent Transportation Systems.

The Mineta Transportation Institute presents an annual symposium by videoconference as part of its ongoing mission to provide technology transfer, education and research on current issues and emerging solutions in the field of sustainable surface transportation. The videoconference is part of the Garrett A. Morgan Technology and Transportation Futures Program, which was established by the Honorable Rodney Slater, former Secretary of the U.S. Department of Transportation.

Teachers and students address the topic of sustainable transportation and propose innovations for the surface transportation industry. The purpose of the symposium is to stimulate the minds of young people and encourage them to excel in mathematics and science, which could lead to careers in transportation engineering, transportation planning, environmental science, public transportation, and innovations in transportation safety and security.

Through the efforts of many people, this event and this publication will add to the positive spirit of innovative transportation progress so ably personified by Garrett Augustus Morgan.

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