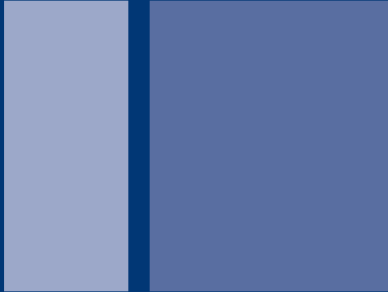


Sixth National Garrett Morgan Symposium On Sustainable Transportation




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Report 05-xx

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**SIXTH NATIONAL GARRETT MORGAN SYMPOSIUM
ON SUSTAINABLE TRANSPORTATION**

March 28, 2006

a publication of the
Mineta Transportation Institute
College of Business
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16. Abstract <p>The Mineta Transportation Institute brought together experts in surface transportation and students from elementary, middle, and high schools to discuss sustainable transportation topics on March 28, 2006. The goal was to introduce the students to transportation-related careers and to inspire them to pursue the academic curricula that would lead to success in those careers. Students from California, Maryland, Virginia, and Washington, D.C., participated in a videoconference, during which they heard a keynote statement from the U.S. Secretary of Transportation Norman Y. Mineta.</p> <p>The students also presented project proposals for innovative transportation alternatives during the videoconference. The presentations were followed by a moderator-led question-and-answer period featuring peer review of the projects and discussions of the young people's perceptions of critical transportation issues that they will face in the future. This publication is an edited summary of the March 28, 2006, event.</p>			
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We are deeply grateful to the many people who contributed to the success of this event. Foremost is U.S. Secretary of Transportation Norman Y. Mineta for the generous gift of his time and for his continuing support of the Garrett A. Morgan Program, a program that has influenced the lives of thousands of young people over the years. For hosting Secretary Mineta, our thanks go to Director of Management and Business Development Jack Basso at the American Association of Highway and Transportation Officials (AASHTO).

The success of the Garrett Morgan symposium is a direct result of the volunteer efforts of Mineta Transportation Institute trustees and their organizations who sponsor the participating schools. In 2006, these were:

- Executive Director John Horsley of AASHTO, sponsoring Ms. Barbara Musser's ninth-grade class from Leonardtown High School in Leonardtown, Maryland;
- Director Will Kempton of the California Department of Transportation (Caltrans) with District Director Tom Hallenbeck, Caltrans District 9 in Bishop, California, sponsoring Ms. Sandra Burn-Hinkel's sixth-grade class and Mr. Bill Hunt's eighth-grade class from Big Pine School in Big Pine, California; and District Director Bijan Sartipi, Caltrans District 4 in Oakland, California, sponsoring Wells Middle School in Dublin, California (this year's middle school winner);
- President William Millar, American Public Transportation Association (APTA), sponsoring Ms. Lee Carpenter's tenth-grade class from the Transportation Technology Academy of Francis L. Cardozo High School in Washington, D.C., (this year's senior division winner);
- General Manager Michael Townes, Hampton Roads Transit, sponsoring Mr. Dennis Borgerding's eighth-grade class from Kemps Landing Magnet School in Virginia Beach, Virginia, the winner of the 2005 competition, and also sponsoring Ms. Renita Jordan's eighth-grade class from Churchland Middle School in Portsmouth, Virginia.

This nationwide videoconference was made possible by Will Kempton at Caltrans, with the support of John Horsley at AASHTO, William Millar at APTA, and Michael Townes at Hampton Roads Transit. Thanks go to the videoconference technicians at the Caltrans Network Operations Center in Sacramento, California, the Association of American Railroads (AAR) and the Academy for Educational Development (AED) sites in Washington, D.C., and at Vicom in Virginia Beach, Virginia.

For their work in publishing this report, MTI thanks the following people: Communications Director Leslee Hamilton, Project Manager and Writer James Swofford,

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FOREWORD

The Garrett A. Morgan Symposium on Sustainable Transportation in the twenty-first century is part of the Mineta Transportation Institute'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 was 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 and continued through the support of Transportation Secretary Norman Y. Mineta.

Students from the middle K-12 grades addressed the topic of sustainable transportation and proposed innovations for the surface transportation industry. This account of the videoconference proceedings provides an interesting look into the thoughts of these students, who showed great promise as the next generation of transportation leaders. This publication is intended to give teachers and transportation professionals alike a glimpse at the creativity and capabilities of this up and coming generation.

Thanks to the efforts of the many people previously acknowledged, this event and this 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 Congress for his contributions to transportation and public safety.



Rod Diridon

Executive Director

EXECUTIVE SUMMARY

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 Sixth National Garrett Morgan Symposium on Sustainable Transportation on March 28, 2006. The purpose of the symposium was to stimulate the minds of young people and encourage them to excel in mathematics and sciences, which could lead to careers in transportation engineering and planning, and innovation in general.

PURPOSE

The middle-school curriculum includes a class or team project on sustainable transportation and culminates in this national videoconference symposium featuring presentations by each of the participating classes. It is designed to increase students' awareness of transportation issues, interest them in careers in transportation, and motivate them to take the appropriate classes in high school that will prepare them for engineering and public administration majors in college.

BROADCAST SITES

The videoconference was conducted through five broadcast sites:

- In Washington, D.C., the American Association of State Highway Transportation Officials (AASHTO) sponsored Leonardtown High School from Leonardtown, Maryland, and the American Public Transportation Association (APTA) sponsored Frances L. Cardozo High School from Washington, D.C.;
- In Virginia Beach, Virginia, Hampton Roads Transit sponsored Kemps Landing Magnet School from Virginia Beach and Churchland Middle School from Portsmouth, Virginia;
- In Bishop, California, Caltrans District 9 sponsored Big Pine School from Big Pine, California; and
- In Oakland, California, Caltrans District 4 sponsored Wells Middle School from Dublin, California.

EVENT HIGHLIGHTS

U.S. Secretary of Transportation Norman Y. Mineta welcomed the students from the AASHTO site. He spoke to them about the importance of transportation to American life. Secretary Mineta also encouraged the young people to work hard in school, study the sciences and mathematics, and pursue careers in transportation.

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

- Kemps Landing Magnet School students from Mr. Dennis Borgerding's eighth-grade class proposed *Independent Mass Transit*, a regional transportation network integrating a Maglev highway system and vehicles energized by helium-3 fusion.
- Big Pine students from Mrs. Sandra Burns-Hinkel's sixth-grade class proposed the *Deep Fried Ride*, a memorable project name for a new motor vehicle designed to run on recycled cooking oil.
- Leonardtown High School students from Ms. Barbara Musser's ninth-grade class presented the *HydroBus*, a futuristic transit vehicle powered by a hydrogen engine fueled with seawater.
- Wells Middle School students from Mr. Mark Woy's eighth-grade class proposed the *TEAPOT*, a garbage truck that used the trash it collected to make its own fuel—methane gas.
- Churchland Middle School students from Ms. Renita Jordan's eighth-grade class proposed the *Wolverine*, a sports car powered by compressed air.
- Big Pine students from Mr. Bill Hunt's eighth-grade class presented a study on the feasibility of recycling waste cooking oil for local biodiesel fuel production.
- Cardozo Senior High School students from Ms. Lee Carpenter's tenth-grade class proposed *Senior High Rail*, which covered the steps necessary to plan, design, and construct an environmentally friendly streetcar system to transport students to and from school.

A question-and-answer session followed the presentations, moderated by MTI Research Director Trixie Johnston. Students asked questions about each other's presentations, and also questioned the transportation professionals in attendance from each of the sponsoring organizations. MTI Executive Director Rod Diridon's tribute to inventor Garrett Morgan ended the symposium.

The Wells Middle School *TEAPOT* presentation was selected the winner for devising a solution to a sustainable transportation problem using commercially available components. The winning team, Dameon Haley, Michael Magee, Alex Pastran, and Jamie Somerville, along with Jamie's mother, Mrs. Joyce Somerville, and teacher Mark Woy were honored at the June 2006 MTI Scholarship Awards Banquet in nearby San José, California, where they received a check for \$500 for their school.

The Cardozo Senior High School team received special recognition for their initiative, scholarship, and for demonstrating how sustainable transportation principles may be used to address local issues. Their street car project included role-play scenarios, original research, and comprehensive documentation of their efforts. Student representatives Brittany Clark and Diana Contreras, along with Diana's mother, Maria Contreras, and their teacher, Ms. Lee Carpenter, received an expense-paid trip to the 2006 MTI Scholarship Awards Banquet in San José, California, plus a \$500 check for their school.

The teachers of all participating classes received a \$50 gift certificate for classroom supplies, awarded upon completing the post-conference evaluation.

KEYNOTE ADDRESS

ROD DIRIDON

Executive Director, Mineta Transportation Institute

The Mineta Transportation Institute at San José State University is very happy to be presenting the 2006 annual National Garrett Morgan Sustainable Transportation Symposium. My name is Rod Diridon, and I am the executive director of the Norman Y. Mineta International Institute of Surface Transportation Policy; we call that the Mineta Transportation Institute for short.

The Institute was created in 1991 by then Congress member Norman Mineta, who was the chair of the Surface Transportation and Infrastructure Committee at that time. Our responsibility is to do studies in the area of transportation policy for Congress and for the California legislature, and to conduct transportation education programs to encourage the next generation of transportation managers to be prepared for their responsibilities.

The objective of this videoconference is to teach young people across the nation that they have the opportunity for careers in transportation. Also, that in order to take advantage of those opportunities, they need to take the courses in high school math and science that will allow them to proceed to college where they can study for the engineering or accounting or other degrees that allow them to proceed into careers in transportation.



Figure 1 Rod Diridon, MTI Executive Director

Those careers may be in a state department of transportation, like Director Kempton is operating here in California, or it may be operating a bus system, a trucking company, or a big railroad. In order to do that, you have to take the technical courses in college. The only way you can do that is to take the math and science courses in high school.

Now it is my distinct pleasure to introduce someone who Secretary Mineta and I have known for a long time, and that is Director Will Kempton. Will became acquainted with us when he was directing the Measure A construction projects in Santa Clara County where he was able to build over a billion dollars worth of highway projects in a ten-year period of time, on schedule and on budget. Now he is in Sacramento as the director of the California Department of Transportation, and he will introduce the Secretary of Transportation.

WILL KEMPTON

Director, California Department of Transportation

Welcome to all. I want to particularly welcome you, Mr. Secretary, along with the students. This is a great program, and it is always fun to see all of the bright young people involved.

When I was in middle school, I was not thinking about a job in transportation, I was more interested in politics. I attended graduate school at California State University in Sacramento and I had a chance to go into state government in my first job, which was with Caltrans.

Now I head the organization. I have 22,450 employees and nearly all of them will either be retired or be getting ready to retire by the time the students that we are talking with today are out of school and looking for a job. I hope that some of you will want a job in transportation to help build, operate, and maintain the bridges, roads, highways, airports, and transit systems of tomorrow. There may be a future Garrett Morgan among us today, someone who sees a need and comes up with an innovative solution to a transportation problem. With the course of study that you have accomplished as part of this program, you know more about sustainable transportation in this country than do most adults.

At last year's awards banquet with the other members of the Mineta Institute Board of Trustees, I got to meet Krista O'Connell, the young lady who represented the winning team from Kemps Landing Magnet School. She was a very bright and a very impressive young lady. I immediately wrote her a job offer on my business card so that when she

graduates from college we will welcome her into the ranks of the Department of Transportation in California. I am very encouraged about our future when I see students like Krista, and all of you, ready to follow in the footsteps of America's transportation pioneers. I am also honored to be able to introduce one of those pioneers with us today, Secretary of Transportation Norman Mineta.

Secretary Mineta, too, is an example of a young person who overcame the challenges of adversity and through education and hard work became a great figure in American transportation. You may not know this, but when Norm Mineta was a middle school student during World War II he lived in an internment camp for Japanese-Americans. Yet he rose above those circumstances and went on to graduate from the University of California at Berkeley. He joined the military, was elected mayor of the City of San José, and later was elected to the United States Congress. He is recognized as an advocate for civil rights and an adviser to presidents.

Secretary Mineta is the first Asian-American ever to serve on the president's cabinet when he was appointed secretary of commerce to President Clinton. Now he is secretary of transportation for President Bush. As secretary of transportation, Secretary Mineta oversees an agency with almost 60,000 employees and a \$61.6 billion dollar budget. Created in 1967, the U.S. Department of Transportation brought under one umbrella all the nation's transportation in the air, on the sea and on the land.

It is my pleasure, my distinct honor, to welcome the longest serving secretary in the history of the United States Department of Transportation, Secretary of Transportation Norman Y. Mineta.

THE HONORABLE NORMAN MINETA

Secretary, U.S. Department of Transportation

Thank you very much, Will, for your kind introduction. I want to commend you for the great job you are doing as the Caltrans director and I also want to thank Rod Diridon for the great job that he and his staff are doing at the Mineta Transportation Institute. I also am very pleased to be able to join with Jack Basso, Bill Millar, Michael Townes, Tom Hollenbeck, and Bijan Sartipi in this symposium.

I want to welcome all of the students who are joining us today from the Atlantic to the Pacific. We are so glad that all of you are with us to talk about keeping America moving forward well into the twenty-first century.



Figure 2 Norman Mineta, Secretary of Transportation (left), with students

Safe and reliable transportation is something that we often take for granted in the United States. We do not stop to think about how we got from Point A to Point B, or how our newest pair of jeans got to the local mall from a far away factory.

Our modern day transportation system is truly a marvel. It helps us to get to work or to school on time. It gets our favorite basketball team or football team from one city to another, and it gets billions of dollars of goods delivered to supermarkets and other stores every day.

Here are some interesting facts about our system that may surprise you. Americans travel 11 billion miles every day and some 19 billion tons of goods and products move across our country every year. In 2005, almost 700 million people traveled by airplane in the United States. By the year 2015, 1 billion people are expected to fly annually. Each weekday more than 14 million Americans ride public transit, including buses, trains, and trolleys.

Transportation accounts for more than two-thirds of the petroleum consumption in America, and it supports millions of jobs.

As you can see, transportation is fundamental to our way of life in the United States. Moving all of these people and products requires a great amount of collaboration and energy, and the United States Department of Transportation is a key player in making sure that our system is safe, reliable, and efficient.

Let me share a few examples. We help save lives by reminding people to buckle up and to stay away from drugs and alcohol when they get behind the wheel. We help ease traffic jams on our roads and in our skies, protect disabled travelers from discrimination, and push for better fuel efficiency for our cars and trucks.

We certainly are not alone in our efforts. In 2002, nearly 20 million people were employed in the transportation sector. This total includes men and women in private industry and in local, state, and federal transportation departments who work very hard to ensure that we continue to have a top notch transportation system.

As our nation and our economy continue to grow, so does our need for safe and reliable transportation. That means we need to maintain and even expand our pool of transportation talent, to help us meet our growing needs and address the emerging mobility challenges that we are facing.

These challenges include fighting the traffic that chokes our cities and communities. Traffic jams, freight tie-ups, and airport delays waste energy, reduce air quality, and cause Americans to be less productive and spend less time with their families. In fact, the average American driver is spending the equivalent of more than a week of work sitting in traffic every year. Being stuck in gridlock adds up. It costs motorists more than \$63 billion dollars a year in wasted time and fuel costs.

America cannot afford to be tied up in traffic, so we must address congestion and other transportation mobility challenges now, before it is too late. That is where all of you students fit in.

We need your help. America needs more bright, creative, and ambitious people to pursue careers in transportation. These jobs are not only challenging, but also exciting—from designing fuel-cell technology in high-tech cars and trains, to building bridges, roads, and tunnels; or, you could focus on aviation and help to create more technologically advanced airports and airplanes, and maybe even a few space stations.

If you think you would like to pursue a career in transportation, or any technical field, I encourage you to take plenty of math and science courses. Those are important fundamentals for most transportation careers.

President Bush understands that education is the key ingredient for keeping America moving forward in the twenty-first century and beyond. Since the beginning of his first term, the president has stressed the importance of subjects like math and science, and as part of the Fiscal Year 2007 budget, he has provided billions of dollars to strengthen education in these very important fields.

Now I have to tell you that I could have used some help honing my own math skills when I was a younger man. When I entered college, I thought I would be an aeronautical engineer. But then my calculus course got in my way, and after careful consideration, I decided that for the safety of the country and my own future, perhaps I should find something else to do. Little did I suspect that when I was struggling with differential equations, that my own future would have me working with all sorts of engineers, most of whom were in the transportation field, and most of whom had aced that pesky calculus course.

While I have spent the majority of my career in public service, my focus has been on transportation. I tell you this because being involved in transportation does not necessarily mean that you need to design and build America's next generation of roads and bridges. From my time as a city council member and then as mayor of San José, California, to my time as a member of Congress and now my tenure as secretary of transportation, I have been involved in making decisions about transportation. So, to me that qualifies me as a part of the transportation team. All kidding aside, most people probably do not give much thought to our transportation network in action, but as we place greater demands on the system every day, we need educated and skilled people with fresh ideas and new solutions to conquer the challenges that we face.

I hope that what I have said inspires you to join the transportation team in one way or another, but most importantly I want to thank all of you across the country for participating in the 2006 National Garrett Morgan Symposium on Sustainable Transportation. I want to wish all of you the best of luck in the future in whatever endeavors you may want to take. May God bless each and every one of you, and may God continue to bless the United States of America.

STUDENT PRESENTATIONS

Trixie Johnson, research director of the Mineta Transportation Institute, was moderator of the student presentations and the following question-and-answer period. Mrs. Johnson described the procedures to be followed by each of the schools, established the order of the presentations, and set a seven minute time limit per school.

Representatives from the host organizations, in turn, identified and welcomed the distinguished guests present at their location and introduced the teacher from the school that they had sponsored. Each teacher then introduced the student(s) who would make the presentation for their school or group.

The distinction of being first to present went to Kemps Landing Magnet School, whose students had won the competition the previous year. Their sponsor, Hampton Roads Transit President Michael Townes, proudly introduced their teacher, Dennis Borgerding, and the students from Kemps Landing who participated in this year's symposium.

KEMPS LANDING MAGNET SCHOOL, EIGHTH GRADE

Independent Mass Transit

Project Team: Christina Kyriakides, Jennifer Morben, Alex Pawlowski, Piper Riddle, and Rachel Spencer, equipment manager Jennifer Samuels, with project assistants Anne Lawrence Balmer, Taylor Hunt and Taylor Wilson.

Instructor: Dennis Borgerding

Sponsor: Hampton Roads Transit, Michael Townes, President



Figure 3 Kemps Landing Magnet School, Eighth Grade

Kemps Landing students proposed *Independent Mass Transit* (IMT). The IMT system comprised three-tiered, electromagnetic roadways designed specially for hybrid vehicles powered by gas and electromagnetic force (EMF), with the electricity generated by helium-3 (He^3) fusion reactor power plants.

Each roadway level served a specific purpose—a low-speed tier for short distances, a medium-speed tier for intermediate distances, and a high-speed tier for long distances. Vehicles on each tier traveled at the same speed except when merging or exiting. A three-dimensional model was used to illustrate the system.

The team began by describing current transportation problems from air pollution, high fuel costs, traffic congestion, and low mass transit use in suburban and rural areas, as well as issues specific to their geographic locale. Their proposed solution featured personal vehicles with space-age characteristics. Global positioning satellites and computers controlled speed and intervehicle spacing. Fossil fuels were used only for low-speed, short-distance travel, with the electromagnetic infrastructure powering the other higher-speed modes.

A technical description of electromagnetic propulsion was given, along with a discussion of the physics and chemistry of helium-3, a rare element on earth, however abundant on the moon.

The team presented comparative costs with other transit modes, and theorized that with a construction cost of \$1.9 billion per 20-thousand miles of IMT system, it was a bargain compared to the more than \$440 billion that Americans spend on gasoline every year.

The Kemps Landing presentation included oral reports by five of the team members, supported by the model and computer graphics. They also prepared a separate written document with a bibliography of sources.

BIG PINE SCHOOL, SIXTH GRADE

Deep Fried Ride

Project Team: James Baldwin, Allie Mackey, Mariah Murray, and Kelsey Nikolas

Instructor: Sandra Burns-Hinkel

Sponsor: Caltrans District 9, Tom Hallenbeck, District Director



Figure 4 Big Pine School, Sixth Grade

The catchy project name, *Deep Fried Ride*, described a new motor vehicle designed to run on “greasel,” or recycled cooking oil. The Big Pine School sixth-grade students presented a scripted oral report, supported by poster board graphics and a model car, to propose an alternative-fuel vehicle powered by waste kitchen grease.

The benefits stated by these young people were notable. First, there will be no more polluted air. Second, because this form of biodiesel is not foreign oil, there will be no more wars over fuel. Finally, since restaurants usually must pay to dispose of it, they enthusiastically cheered, “They will give it to you for free!”

The technical aspects of powering a diesel motor vehicle with greasel were described, including the various temperatures required to start a diesel engine and to maintain the fluid nature of the fuel. Challenges to using this biodiesel fuel were identified as oxidation in hot weather and solidification in cold weather. Possible solutions to these problems were

suggested, such as temperature-control systems in the vehicle, and research into chemically modifying soybean oil to affect the temperature stability of the grease.

The students pointed out that the new fuel was biodegradable, inexpensive, and renewable. But they recognized that other alternative fuels are needed, observing that if the whole world had grease-powered cars, there would not be enough grease to satisfy everyone and greasel would become very expensive.

LEONARDTOWN HIGH SCHOOL, NINTH GRADE

HydroBus

Project Team: Daniel Carmack, Christian Erk, and Austin Toombs

Instructor: Barbara Musser

Sponsor: AASHTO, John Horsley, Executive Director



Figure 5 Leonardtown High School, Ninth Grade

Leonardtown High School sits in the heart of the Maryland peninsula, which is surrounded on three sides by water. Leonardtown students drew on their environment to propose a hydrogen-powered bus fueled by seawater. They presented a lengthy oral report, supported

by computer-based graphics, which was accompanied by a brief written document with bibliography.

The students presented a history of the development and use of the bus, that venerable mainstay of mass transit. They compared its present-day capabilities and economics with those of their proposed future design which featured numerous amenities for passenger comfort and safety. They noted the difference between equipment used for commuter service and that used for long-distance travel. Of note was their awareness of, and sensitivity to, the needs of people in wheelchairs or with other personal challenges.

The last part of their presentation covered the technical operation of the bus' hydrogen engine, with its environmental benefits clearly explained.

WELLS MIDDLE SCHOOL, EIGHTH GRADE

TEAPOT

Project Team: Dameon Haley, Michael Magee, Alex Pastran, and Jamie Somerville

Instructor: Mark Woy

Sponsor: Caltrans District 4, Bijan Sartipi, District Director



Figure 6 Wells Middle School, Eighth Grade

Wells Middle School proposed the Trash Energy Alternatively Powered Organic Truck, with the clever acronym *TEAPOT*, in which a garbage truck used the trash it collected to make its own fuel—methane gas. The students presented an oral report, supported by computer-based graphics and a written document with bibliography.

Their presentation was concise and easy to understand, with occasion bits of humor to hold audience interest. Their live presentation gave an overview of the more detailed information provided in the written document. The “How It Works” segment showed, in simplified form, the steps for recovering and using methane generated by waste products to power a diesel motor. They illustrated the engine’s components and functions through computer animation. Furthermore, they reassured everyone that their vehicle “would not stink.”

The Wells Middle School students showed how, with less than \$100 worth of special parts, their system could be applied today in conventional, production-line vehicles. A key mechanical component in their truck was the Bate Auto Gas Converter, which was devised by British inventor Harold Bate in the early 1950s and successfully fieldtested for over twenty years. The Wells students summarized their presentation by describing their system’s advantages and how they achieved sustainable transportation goals.

For the academic tenets displayed through their research, for the clearness of their presentation, and for their practicality in devising a solution to a sustainable transportation problem using commercially-available components, the Wells Middle School team was chosen the winner of the 2006 Garrett Morgan Symposium.

CHURCHLAND MIDDLE SCHOOL, EIGHTH GRADE

Wolverine: The Wave of the Future

Project Team: Rami-Peter Dabeet, Sarah Davidson, William Drum, Briana Euell-Pilgram, Nicole Gunawansa, Travis Moorehead, and Dallas Walton

Instructor: Renita Jordan

Sponsor: Hampton Roads Transit, Michael Townes, President



Figure 7 Churchland Middle School, Eighth Grade

Churchland Middle School students made the most elaborate presentation of the symposium. They introduced *Wolverine*, loosely, an acronym for a wind oxygen-powered land vehicle efficiently using resources including new energy sources. The *Wolverine* was conceived as a hybrid automobile, featuring small, fossil-fuel motors turning alternators to supply electricity for fans that propel the vehicle by air pressure.

Dressed in white lab coats, the Churchland team gave a lengthy, dramatic, multimedia presentation, including an oral narrative, supported by computer-based graphics, poster boards, a scale-model car, and a portfolio of marketing-like promotional material. Their marketing kit from the “Wolverine Car Company” featured an attractive product announcement package worthy of Detroit and Madison Avenue.

The Churchland students declared that the *Wolverine* would “break the nation’s addiction to oil.” Ties between their concept car’s features and the tenets of sustainable transportation were presented abstractly through their presentation graphics and printed literature.

BIG PINE SCHOOL, EIGHTH GRADE

Biodiesel in the Owens Valley

Project Team: Skylar Ameson, Alesha Baumgartner, Natalie Henderson, Mariah Meza, Holden Rangel, Alex Tash, and Rusty Tillamens

Instructor: Bill Hunt

Sponsor: Caltrans District 9, Tom Hallenbeck, District Director



Figure 8 Big Pine School, Eighth Grade

Big Pine School eighth-grade students' presentation was in two parts. They gave an oral report, supported by computer-based graphics, first on the historic and scientific aspects of the diesel engine and biodiesel fuel, and secondly on the feasibility of biodiesel fuel recycling in their community.

They began their presentation with a lengthy overview of the history and technology of diesel engine development and early uses of organic fuels. They noted that the first diesel engine was fueled by peanut oil, and an early Ford Model-T engine was fueled by ethanol alcohol. Then they presented a detailed discussion of the chemical and environmental properties of biodiesel fuels.

A highly commendable component of their project was the original research that the Big Pine students conducted. Described in the second part of their presentation, the students looked into the possibility of using recycled cooking oil as a potentially untapped local resource. They described their methodology and the results of their survey of fast-food

restaurants in the town of Bishop, California. In true scientific fashion, they documented their findings, analyzed the data, and used it to reach supportable conclusions.

The Big Pine students found that just four fast-food restaurants produced 114,875 gallons of waste cooking oil per year—this from a regional population of about 18,000 residents plus the transient population from tourism and travelers on Highway 395. The students noted that most of the local waste cooking oil presently was being discarded in the trash. Their logical hypothesis was that in a large city the yield of waste cooking oil available for recycling into biodiesel fuel would be millions of gallons.

CARDOZO HIGH SCHOOL, TENTH GRADE

Cardozo Senior High Rail

Project Team: Brittany Clark, Diana Contreras, and DeShawn Ross, presenters; Cetavia Boyd, Kevin Corbie, Keir Johnson, Vontia Rogers, and Delonte Smith, construction engineers; Steven Belk, Jasmine Duckett and Miao Li, design and display; Marsh Casey, Clifford Ford and Jose Salazar, computer graphics

Instructor: Lee Carpenter

Sponsor: APTA, William Millar, President



Figure 9 Cardozo High School, Tenth Grade

Cardozo High School students proposed a streetcar system to transport students to and from their school using sustainable transportation. Their project included an oral presentation, supported by poster board and computer-based graphics. Additionally, they participated in transportation planning role-play scenarios and conducted independent research and analysis of local conditions and needs, all documented and published in a project journal.

During their presentation, the Cardozo students' narrative supplemented information on the computer screen, rather than repeating it. They quickly and concisely described the objective and scope of their project and the resulting two-part planning effort.

During the first planning phase, the students conducted surveys to determine local needs, analyzed the survey data, met with special interest groups (in role-play sessions), and identified project funding sources. The second phase covered design and construction of the system (again in role-play scenarios). Design characteristics were carefully considered to meet sustainable transportation goals.

A remarkable element of their project was the speed with which they said it could be constructed: ground-breaking and track construction in one week; shelters erected the second week; route signs posted the third week; operational testing prior to the ribbon-cutting ceremony, which took place in the sixth week. The students noted that because of their extremely fast construction, "the Cardozo team is now in demand by every contractor in the metropolitan area."

Cardozo Senior High School received special recognition for their scholarship, initiative, and for demonstrating how sustainable transportation principles may be used to address local issues.

QUESTIONS AND ANSWERS

INTRODUCTION

Trixie Johnson, Moderator: The next part of the program is where the students ask the questions. We have asked each of the classes to be prepared for questions.

One of the things you are going to do now is ask one question of another school about their project. This will be something to clarify or make clearer what their project does or how they went about it.



Figure 10 Trixie Johnson, MTI Research Director

STUDENTS QUESTION STUDENTS

Kemps Landing Magnet School

Question from Kemps Landing student Christina Kyriakides: We would like to ask Leonardtown High School from Maryland about their hydrobus. While we have present day bus systems, they are under utilized due to the many disadvantages of riding a bus: travelers must follow set schedules and travel to set bus stops, which are often

inconvenient. So, in light of this information, what makes you think that hydrobuses will be used if regular buses are not used today?

Leonardtwn Student Christian Erk answers: Regular buses are used often in the city that we are in—Washington, D.C. Buses are used to transport people from street corner to street corner across the city to just about anywhere. There is no limit to where a bus can go if there is a road.

Big Pine School, Sixth Grade

Question from Big Pine sixth-grade student Mariah Murray: We would like to ask the Kemps Landing Middle School from Virginia Beach what would happen if the magnets broke down?

Kemps Landing student Rachel Spencer answers: For Level 1, all the cars are run normally; it is only when you get on Level 2 or Level 3 that the electromagnets switch on to power the car. So if the magnets had a problem, the car would automatically switch back to the normal phase to drive.

Leonardtwn High School

Question from Leonardtwn student Christian Erk: We would like to direct our question to Churchland in Virginia. How does the process start in the engine? How does the process begin to push the air through and out the back through the engine?

Churchland student Dallas Walton answers: The air is first sucked in through the screened off area where the grill would be located and is then filtered and pushed out by three aluminum fans which are powered by a small chainsaw like motor.

Wells Middle School

Question from Wells Middle School student Jamie Somerville: This is for Churchland. We would like to know how fast a car would go that is powered by air.

Churchland student Dallas Walton answers: The car is made out of an aluminum alloy so it is light enough to be pushed by the air and it would be like a normal car. A regular car could hit 0 to 60 in about 30 seconds, so with this, it would probably be almost the same, maybe a little bit quicker. It could probably go up to the top speed of a normal car.

Churchland Middle School

Question from Churchland student Dallas Walton: We would like to ask Kemps Landing: with your car, what if the magnets interfere with the GPS? You could be trying to go maybe a block away and start heading to Mexico instead.

Kemps Landing student Christina Kyriakides answers: If you are going a block away, then you would use the first level of the system, so there would not be magnets.

Kemps Landing student Rachel Spencer answers: Also, the Navy and the military use highly refined GPS units, so we would use very high quality GPS units.

Churchland student Dallas Walton rebuts: If the magnet is that close, it does not matter how good the GPS is, it can still mess with the information.

Kemps Landing student Piper Ribble answers: It uses electromagnets. If it is not coming from the main computer system, then ...

Big Pine School, Eighth Grade

Question from Big Pine eighth-grade student Holden Rangel: Wells Middle School, how much trash produces one gallon of methane and how long does it take?

Trixie Johnson: They are asking about your methane production.

Wells student Michael Magee answers: (After calculation) That is 4.86 cubic feet.

Trixie Johnson: How much time to do that, do you know? He was asking about the time to get your methane.

Wells student Jamie Somerville answers: A day.

Cardozo High School

Question from Cardozo student Delante Smith: I would like to ask Big Pine School eighth grade in California, were you disappointed to discover that technology had progressed only to the point of using just 20 percent of renewable resources?

Big Pine student Alesha Bumgarner answers: It was disappointing to find out that it was only 20 percent, but we were happy with the way our project ended up.

STUDENTS QUESTION EXPERTS

Trixie Johnson: We have completed the first round of questions and we will be using that in how we assess your performance today both in the question you asked and how you answered. The other thing that we asked each school to do is to have a question for some of the sponsors that are here today, the transportation experts—questions particularly about careers in transportation that might help you decide what to do about future school plans or potential jobs that you might be thinking about. You also could consider questions about transportation in general, because these are the people who know the answers.

Kemps Landing Magnet School

Question from Kemps Landing student Rachel Spencer: We will ask our question to the California transportation director. With many new changes in transportation coming in the near future, many new job opportunities will become available. How do you see these jobs affecting the economy in the near future and far future; and also, will it be similar to the economic boom of the 1920s, with the invention of inexpensive cars?

Larry Orcutt: Director Kempton had to leave; this is Larry Orcutt filling in. I am the division chief for research and innovation. The first part of the question is about how jobs are going to change. As you are probably aware, judging from the impressive computer presentations today and your use of the Internet, there are going to be more technology-based jobs. I think there are still going to be civil engineering jobs; that is our primary discipline here in Caltrans. Our need is for people to be specializing in those areas, because I think jobs are going to be more technology-based.

The last part of your question was how that affects the economy. The economy, the infrastructure, taking care of the infrastructure, and also taking care of congestion, which several of you have talked about, are critical issues that the country needs to solve. I think we definitely need engineers and scientists in the future. If we cannot solve those problems, there is definitely going to be a negative effect on our economy as we try to move goods and services in our country.

Trixie Johnson: So, technology and money are two of the things we are going to be worrying about in the future; things that you will be concerned with as you look for jobs.

Big Pine School

Question from Big Pine student Allie Mackey: Mr. Orcutt, what are the qualifications for becoming an engine designer?

Larry Orcutt: I am not sure I am the best person to answer that question. An engine designer probably would be a mechanical engineer.

Trixie Johnson: I think you are correct, Larry. My husband was trained as a mechanical engineer and that is part of what he worked on.

Leonardtwn High School

Question from Leonardtown student Christian Erk: We would like to ask Mr. Jackson about this new technology on these presentations. How will these affect the future of your job in planning and developing new ways for transportation?

Tate Jackson: We are going to have to find new ways to manufacture, store, and distribute alternative fuels. How to transport the fuel, and all of the jobs that are going to be needed to support that, can only mean more jobs and a better economy, in my opinion.

Wells Middle School

Question from Wells student Patrick Luntey: What are the chances of our projects actually making it into transportation—getting to be real?

Larry Orcutt: I think many of the presentations that were made today have excellent opportunities to being included in the future of transportation. Many of you focused on fuels as a key need for transportation because you know we have to have fuel to power the vehicles. There also was some discussion about the independent mass transit system. There are new ideas that are currently being proposed by automobile manufacturers to communicate between the car and the roadside, so that someday you will be able to download music, access the Internet as you are driving; of course, the driver should not be the one doing that. But there are things that are in the works today to do many of the things that all of you talked about.

Trixie Johnson: So you were not as futuristic as you thought. Maybe these could be real things.

Churchland Middle School

Question from Churchland student Dallas Walton: This is for Mr. Orcutt: what are our safeguards for when our oil supply diminishes?

Larry Orcutt: Right now there really are not any safeguards, but I think there are many initiatives being pursued. Here in California, one of the things the governor has us pursuing is the hydrogen highway. Tate Jackson already mentioned the difficulties in getting the fuel out and to the vehicles. We also have vehicles using compressed natural gas. So, I think there is a move to use alternative fuels in this country. One of the big challenges we are going to face with most of the new technologies will be whether people accept a new type of fuel and buy the vehicles that are needed for that.

There are many challenges out there, but I think in terms of protection, fossil fuels are going to be here for a while. It is going to take some time to switch over to other fuels, but there are a lot of things going on in that arena.

Big Pine School

Question from Big Pine student Alex Tash: This is for Mr. Orcutt, what fields of science are there in transportation?

Larry Orcutt: Just about everything you can think of. There are people that work on the environmental documents—the sciences behind the air quality issues dealing with the vehicles that many of you talked about are all part of transportation. I think another key part would be the engineers, of course. We have quite a few engineers working for Caltrans. Also there are planners, because I think one of the things that is key to sustainable transportation is to match land use with transportation and also with jobs. All of those things are key for transportation, especially here in California. Because we want to be able to move goods and services, it takes the full range of disciplines to deliver a successful transportation program.

Cardozo High School

Question from Cordoza student Delonte Smith: This question is for Mrs. Johnson. As the research director for MTI, where would you direct students to go in search of information on transportation careers?

Trixie Johnson: Well, it just so happens that we are about to start a study on transportation careers. In about two years, you can come to our website and we will have a report on that,

because everyone is concerned about where we are going to find people to work in transportation. Until then, I would start with career counselors at your high schools, if you are lucky enough to have them. The second thing that I encourage young people to do is to talk to people in the field. Some of you, during your projects, did go out into the field and talk to transit districts about your project. If you are interested in a job or a potential activity, probably the best thing you can do is to talk to someone who is doing that job now. Generally, they will be very interested in talking to you. A number of the agencies that work in transportation have internships so that you can try the jobs out before you actually commit yourself to doing them. That is another way to find out about the kinds of jobs you like. In terms of research, one thing that you can look for in all of the books that you will soon become acquainted with will be where to find scholarships. You will find a number of organizations in transportation that fund scholarships for specific study and they can give you other ideas. All of the colleges have websites and many of their websites are very good. They will tell you about what the different departments will prepare you for. You could go to the civil engineering department at a college, for example, and you will see the kinds of courses that they are offering. That will give you an idea about the kinds of jobs that you would be doing. For example, there could be courses in bridge design, and that gives you a good idea about where you might be doing in the future if you go into that field of study. There are lots of places to look, and you folks have shown yourselves to be very adept at using the World Wide Web, which is usually where I start. There will be lots of books and studies coming out about transportation careers, because everybody is concerned about where we are going to find all the replacements for the people who are retiring. Good luck.

EXPERTS DESCRIBE THEIR WORK

Trixie Johnson: Now we will go to some of our transportation experts and ask what is one thing you would say to these students about the kind of work that you do? I will start with Bijan Sartipi, who is the director here at Caltrans District 4. Tell us a little bit about your job, and what question you think students might ask about it.

Bijan Sartipi: The job that we have here in the San Francisco Bay Area, with respect to transportation, is to be a full service district that does planning, design, construction, operation, and management of the entire transportation system in the region. Any career field that would support any one of those phases would be something that we would be looking for. One of the major construction efforts that is ongoing on is the seismic retrofit

of our toll bridges on the bay. We are replacing the Oakland Bay Bridge with a brand new structure, a signature, self-anchored, suspension span. Any field that would assist in designing that kind of a structure, whether in math, geometry, or also construction, is something we would always look for. In other aspects of work within the department would be anything that supports our work, from beginning to end, from biologists to engineers. Communication is an important aspect of our work. I have seen really great talent in your project presentations, so you've done a great job in communicating what you have been thinking about with respect to the project that you have done. That is an important facet of transportation. I will be looking forward to having you joining us in the future.

Trixie Johnson: I heard a lot of subjects in what he was talking about. There are things you can study and they probably are a broader list of subjects than you might have considered—all of the basic sciences as well as all of the engineering skills. Also, there are things that you would not think of as transportation but that transportation agencies have to have, such as people who manage money, or people who manage people.

Now we will go to the East Coast and to Hampton Roads Transit. What would you like to say to the students about the jobs that you do in running a transit district?

Nannette Bouknight: My function in Hampton Roads Transit is as a communications specialist. What I do is assist internal communications at HRT, to make sure that information flows the way that it should and that there are no gaps. It is another one of those jobs that Mrs. Johnson was just talking about that may not be directly related to transportation, however it is a function that is very necessary in any agency. Does anyone have a question they would like to ask?

Trixie Johnson: What was your major in college?

Nannette Bouknight: I majored in business administration with a concentration in accounting.

Trixie Johnson: So, you may study one thing and end up doing something else. I understand that, because I majored in English.

I am now going to Caltrans District 9 and Mr. Hallenbeck: what would you say about the work that you do?

Tom Hallenbeck: First, I would like to congratulate all of the students nationwide on the great work that they did. It was very interesting for me to listen to your presentations. I want to encourage all of you to continue on with your interest in math and science and

technology. As you might guess, the world is going to get more complex and more technologically demanding. And we must increase our knowledge of the world around us.

Being an engineer has brought me a great deal of pleasure, and I enjoy the job that I have here as the district director. Engineering provides the world with a lot of benefits and a lot of services. No matter how advanced we get using computers, we are always going to need the delivery of clean water or dealing with our wastewater. We are going to need delivery systems for our utilities and electricity. We are going to need a transportation system for the movement of goods and services. That is what we do here in Caltrans to provide that transportation system. It is a noble profession. I take great pride in it, and I encourage all of you to pursue it. I think that you could be future employees and I look forward to having you on board.

Trixie Johnson: Mr. Jackson in Washington, D.C., what is your background, how did you come to transportation, and what message you would have for the students.

Tate Jackson: I was a civil engineer working for the Maryland State Highway Administration for about ten years in various departments. My job here at AASHTO is to run the student outreach program to get as many students as I can to go into transportation careers. For those of you wanting to know about transportation careers, just give me a call, because I have all kinds of information. What I could best tell the students is if you want to get into transportation or civil engineering, math, science, technology education, and communications are all outstanding skills that every engineer needs. But in transportation, we need another skill that you could pick up in social studies class. You have to learn to understand people and society in order to solve their transportation infrastructure problems. So, study math, science, and communication, but definitely do not overlook other areas like social studies and classes that help you understand people.

Trixie Johnson: We are going to go to APTA next and Joe Niegoski.

Joe Niegoski: Like you, I began my career in education. I was a French major, and went from French to adult learning and adult education. Some of the issues that APTA is looking at are about the future. Who are the folks who will have the skills? I think we saw a lot of them here today in this program. There are lots of things that folks can do in terms of transportation careers, on the technology side, the planning side, in marketing, or the financial side.

One of the priorities for our association, as we work with many of your groups, is to help identify what skills people need, and what they should be doing now to have a great career

in transportation. I have been at APTA for four years. I have learned about this industry and again it is exciting. I think there is a great future for all of us.

CONCLUSION

Trixie Johnson summarized the evaluation criteria that the teachers and sponsors should use in assessing each class' presentations. She asked that the evaluations be weighted by grade level because of the wide range of age groups participating in this year's competition. She also asked teachers to evaluate the learning program and class materials to assist the institute in improving future events. The importance of submitting the evaluations to MTI in a timely manner was also emphasized, to assure that they could be included in the judging process to select this year's winner.

Thanks were offered to Caltrans and the other sponsors' support organizations for their work in producing an event free of the technical difficulties that often can occur during such complex endeavors.

The teachers received special thanks from Ms. Johnson for taking the time to present academic studies that might be outside of their normal curriculum. She noted that education systems sometimes do not reward teachers for taking on extra work or doing something new, and, as a former teacher herself, she appreciated their willingness to do that with the Garret Morgan curriculum.

Ms. Johnson congratulated the students on their work and expressed appreciation for their having engaged in something new and different that also might have been an extra assignment for them. She was pleased that they felt it was worth doing, and she hoped that they were excited about some of the things they had studied. She stated that the world will be looking to them for answers to future problems and they seemed to be well-prepared to meet the challenge.

Rod Diridon closed the program by thanking Ms. Johnson for moderating the symposium, and by thanking each sponsor for their support.

He then summarized the history of the U.S. Department of Transportation's Garrett A. Morgan program and the reasons for naming it after the celebrated 19th century African-American engineer (see Appendix A). Mr. Diridon noted that Garrett Morgan was an excellent example of what can be accomplished by persons who apply themselves, and he encouraged the students to likewise work hard in school and recognized that great transportation career opportunities can result from their efforts.

APPENDIX A

GARRETT AUGUSTUS MORGAN (1877-1963)

Garrett Augustus Morgan, the man 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 eleven 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, Morgan made an impact on the course of human events. Shortly before his death in 1963, Morgan was awarded a citation by the U.S. government for his significant inventions.

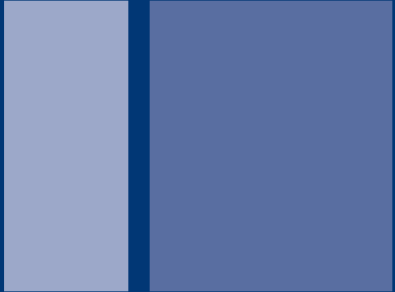
Notably, in 1923, Morgan invented and patented a successful early traffic signal. It was during this time that the automobile, which shared the nation's streets with bicycles, animal-powered wagons, and pedestrians, was becoming common. Accidents were frequent and often bloody. After witnessing such an accident in Cleveland, 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.

The Mineta Transportation Institute presents an annual symposium by videoconference as part of its ongoing mission to provide information 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 sciences, which could lead to careers in transit engineering, transportation planning, and innovation in general.

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.

Fifth National Garrett Morgan Symposium On Sustainable Transportation




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