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Eleventh Annual Garrett Morgan Sustainable Transportation Symposium, MTI Report S-11-01

Mineta Transportation Institute

SAN JOSÉ STATE UNIVERSITY

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MTI

Eleventh Annual Garrett Morgan Sustainable Transportation Symposium

MTI Report S-11-01

September 2011

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The Norman Y. Mineta International Institute for Surface Transportation Policy Studies was established by Congress in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The Institute's Board of Trustees revised the name to Mineta Transportation Institute (MTI) in 1996. 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.

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REPORT S-11-01

ELEVENTH ANNUAL GARRETT MORGAN SUSTAINABLE TRANSPORTATION SYMPOSIUM

September 2011

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16. Abstract

On March 30, 2011, 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 Eleventh National Garrett Morgan Symposium and Videoconference on Sustainable Transportation.

The ongoing mission of this national videoconference is to stimulate the minds of young people, and to encourage them to pursue challenging academic programs including mathematics and science—an education course that will prepare today's students for tomorrow's challenging transportation careers.

Participating school were: Juan Crespi Middle School, El Sobrante CA; Monument Middle School, Rio Dell CA; Morada Middle School, Stockton, CA; Redland Middle School, Rockville, MD (two teams); and Tupelo Middle School, Tupelo MS.

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ACKNOWLEDGMENTS

The Mineta Transportation Institute thanks the following individuals and their agencies for their unwavering ongoing support and sponsorship for the Eleventh Annual Garrett Morgan Sustainable Transportation Symposium, which was held on March 30, 2011. Without their contribution of time and resources, this innovative videoconference educational symposium simply would not be the success it is today.

Thank you to Caltrans Director Cindy McKim; Caltrans Chief Deputy Director Malcolm Dougherty; Caltrans Deputy Director Bijan Sartipi, District 4; John Horsley, CEO, American Association of State Highway and Transportation Officials (AASHTO); United States Secretary of Transportation Norman Y. Mineta (ret.) and current Secretary of Transportation Ray LaHood.

Thank you to this year's classroom sponsors and their organizations: Emma Cleveland, Caltrans District 1; Alfonso Miles, Caltrans District 4; Linda Clifton and Tequamech Tadesse, AASHTO; and Cheryl Pyatt, APTA.

Thank you to this year's participating schools, their teachers and transportation agency sponsors for contributing to the education of tomorrow's transportation industry professionals: Juan Crespi Middle School, El Sobrante CA, teacher Gail Pavlich, sponsored by Alfonso Miles of Caltrans District 4; Monument Middle School, Rio Dell CA, teacher Sheryl Steiner, sponsored by Emma Cleveland of Caltrans District 1; Morada Middle School, Stockton, CA, sponsored by Marcela Anderson of Caltrans District 10; Redland Middle School, Rockville, MD, teacher Kimberly McLurkin-Harris, sponsored by APTA; and Tupelo Middle School, Tupelo MS, teacher Julia Smith, sponsored by Linda Clifton of AASHTO.

Sincere thanks to the technicians at each videoconference site, whose technical know-how and troubleshooting allowed this coast-to-coast video-conference.

As always, MTI thanks the Honorable Norman Y. Mineta for his unwavering support for this event and for promoting the transportation industry as a viable future for young people.

For their work in producing this event and its report, thanks to the MTI staff, including Director of Communications and Tech Transfer Donna Maurillo, Student Publications Assistant Sahil Rahimi, and Webmaster Frances Cherman. Transcription services were provided by Meg Dastrup of Word Power Plus.

Please note that all research for this symposium was performed by middle school students, and the Mineta Transportation Institute cannot verify the content accuracy of each group's presentation.

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FOREWORD

It is our pleasure to present this edited transcript from the Eleventh Annual Garrett Morgan Sustainable Transportation Symposium, which was held March 30, 2011. This event is central to the Mineta Transportation Institute's ongoing goal to provide information and technology transfer. Middle school students are this event's target audience, because they are transportation's future leaders and innovators.

There is no doubt that transportation is a growth industry in both the public and private sector. Our nation has a renewed interest in improving and expanding public transportation, on repairing and improving our existing highway and rail systems, and creating modes of sustainable transportation. This will offer opportunities in all areas of transportation planning, from engineers and urban planners to policy managers and communications professionals.

Where will those talented professionals come from? No doubt, past and future participants in the Garrett Morgan Sustainable Transportation Symposium will provided a good start! Every year the projects are more original and visionary, and each year it is more difficult to select a winner! Students faced many challenges as they conceived and created their sustainable transportation entries for this competition. It compelled them to use many of the skills that are required of transportation professionals—math, physics, chemistry and other sciences, and of course, excellent communications skills.

I'm happy to congratulate all students. They met the challenge. I also to extend my personal thanks to those individuals included in the acknowledgements section. Without each of them, this educational opportunity simply would not have happened.

Rod Diridon, Sr.

Executive Director

Mineta Transportation Institute

EXECUTIVE SUMMARY

On March 30, 2011, the Mineta Transportation Institute (MTI) continued its support of the United States Department of Transportation's Garrett A. Morgan Technology and Transportation Futures Program by conducting the Eleventh Annual National Garrett Morgan Symposium and Videoconference on Sustainable Transportation. The purpose of this national videoconference is to stimulate young people's minds 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

Participating Schools

This year's videoconference schools included:

- Juan Crespi Middle School, El Sobrante CA

- Monument Middle School, Rio Dell CA

- Morada Middle School, Stockton, CA

- Redland Middle School, Rockville, MD (two classes)

- Tupelo Middle School, Tupelo MS

Event Highlights

The students were welcomed by MTI's Communications Director Donna Maurillo, American Association of State Highway and Transportation Officials CEO John Horsley, and Caltrans Chief Deputy Director Malcolm Dougherty. Ms. Maurillo moderated.

She reminded the students that today's activities today are to encourage middle-school students to take technical classes in math and science in high school and direct their interests toward transportation. Then they can qualify for the technical courses in college that will then allow them to become transportation professionals, building US transportation systems in the future.

This year's research presentations included an Air-Flow Rechargeable Car (ARC); Alternative Logical Gas Applied Energy (ALGAE); S S Morada Hybrid Vehicle; The Bullet Train over the Years; A Discussion of Transport Planners; and the Nguyen Bus.

A lively question and answer period followed the presentations, with classes asking questions of each other. Extra points were awarded to schools for each of their questions and answers. At the end of the session, students were addressed by retired United States Secretary of Transportation Norman Y. Mineta and current Secretary of Transportation Ray LaHood, who appeared via videoconference link from the US Department of Transportation site in Washington DC. Each school was allowed to ask one question of Secretary LaHood, who engaged with the students and provided encouragement to complete their educations.

The winning team was announced a week later. Teacher Sheryl Steiner, Caltrans District One sponsor Emma Cleveland, a group of students, and parents traveled to San Jose CA in June to attend MTI's annual scholarship banquet and to accept the grand prize cash award and a plaque.

A biography of Garrett Augustus Morgan is included as Appendix A.

The videoconference, in its entirety, can be viewed at www.dot.ca.gov/research/planning/garrett_morgan_symposium/garrett_morgan_progam.htm

INTRODUCTIONS

DONNA MAURILLO:

Welcome, everybody, to the Garrett Morgan Sustainable Transportation video conference. I'm Donna Maurillo, Communications Director with the Mineta Transportation Institute. We pull this competition together each year, and we're really excited to see all the students here today. Normally, our executive director, Rod Diridon, does all the introductions, but he is making a presentation on high-speed rail in Denmark, so he sends his regards and wishes for best luck to all the students.

Today, we have a coat-to-coast hook-up between the California Department of Transportation district offices here in California, and the U. S. Department of Transportation broadcast center in Washington, D. C. So I trust that everybody can see each other here on the broadcast today.

First, I want to say thank you all for participating. I've reviewed the project descriptions, and we have some really, *really* smart students this year. I'm very impressed. We're especially grateful to the teachers. I know that, for the teachers, this is an extra-curricular activity. So we really appreciate it. My daughter is a teacher, so I know how much time the teachers have already put into the classroom without having to do extra-curricular work. So we truly appreciate what you're able to do.

I also want to note that we expect the U. S. Secretary of Transportation, Ray LaHood, and the retired Secretary of Transportation, Norman Mineta, to arrive sometime after the presentations are completed. As you know, they have very busy schedules, so they have limited time to be here with us, but they really look forward to this every year, and they want to be with you.

Now, for a little bit of history about Garrett Morgan. He was an African-American man, the son of slaves, who realized that being inventive and working hard were the keys to success in the United States. So he went to work and established a clothing business. He was very successful, but he was also an inventor. Most of us are familiar with the zigzag attachment on a sewing machine. Garrett Morgan invented that.

He also invented the gas mask, which is in common use today. The first time it was tested, he tested it himself. There were two people trapped in a tunnel under Lake Erie. There was a lot of smoke in there. He and three other men put on the gas mask, went in, and rescued those two men. He was given several medals for his bravery. So not only was he inventive, but he was also a very brave man who did a lot of good for his fellow man.

But he also invented the four-way traffic signal after he saw an accident at an intersection in Ohio. Because at that time cars and wagons and trucks and people all were working on the street at the same time, crossing the road at the intersections. As traffic was increasing, as more and more cars came on the road, he foresaw that there was going to be a huge problem. So he invented the four-way traffic signal, and it allowed pedestrians to cross the street safely. So that's why we honor him today, for his role in transportation.

He also had a street named for him in Prince County in Maryland. There's a Washington metro stop named for Garrett Morgan, and there's a school of science in Cleveland, Ohio, that's named for Garrett Morgan, as well.

The Garrett Morgan Symposium has been going on for several years, encouraged by the U. S. Department of Transportation, so smart young people like yourselves can consider careers in transportation by studying science and math. The winning team from today's competition will win $1,000 for their classroom. They also will have a plaque. In fact, the top three teams will receive a plaque. And then the winning team will be flown to San Jose, California, to participate in our Garrett Morgan awards presentation in San Jose on June 25. There will be many transportation leaders there from across the country. So it's a very big honor.

Now, for the introductions. Let me please introduce Mr. John Horsley, who is the executive director for the American Association of State Highway and Transportation Officials in Washington, D. C. His organization has sponsored teams every year, and he is here to make some introductions. We're delighted to have him with us. John, would you like to address the students, please?

JOHN HORSLEY

I would, Donna! Thank you very much. I'm pleased to join the Mineta Institute out of San Jose State in welcoming three teams from California. I think we have three or four teams from the Redland Middle School here in Maryland, and the team that has traveled furthest today is Tupelo Middle School in Mississippi that flew up here to Washington, D. C. to represent AASHTO. We have teams from AASHTO, the American Public Transportation Association, which sponsored Redland Middle School, and then Caltrans, out there with your three terrific teams in California. We want you kids to know how important it is for *us* to see *you* showing interest and learning about transportation. We need the next generation to lead us in transportation, and *I* think, in *this* room, and in *your* room, Donna, and in the three districts there in California, we see the leaders of the future that the United States is going to depend on. So we're delighted you've prepared to compete today. We look forward to the competition. Donna, back to you!

DONNA MAURILLO

Thank you very much, John. It's always a pleasure to have you with us. You're a terrific guy! Thank you.

Here in California, Ms. Cindy McKim is the head of the California Department of Transportation, but she couldn't be with us today. She sends her regards, and she sent her chief deputy, Mr. Malcolm Dougherty, to represent her. He will speak to us from Sacramento, California. Malcolm, welcome to the Garrett Morgan competition. Would you like to address the students, please?

Mr. Dougherty: I would! Thank you, Donna, and also thank you, John, and good morning. At least, good morning to those of you in California, and good afternoon to those of you on the East Coast. It is my pleasure to be here, and I'm very much looking forward to seeing the presentations from our six classes today, from five different schools. Again, my name is Malcolm Dougherty. I'm the chief deputy director for the California Department of Transportation, which we affectionately refer to as Caltrans.

First, congratulations to each of the schools, the teachers, the sponsors, the liaisons, and especially the students, for all their achievements thus far in this program. I hope this has been a great learning experience for you, and I hope it continues to be a learning experience as you make your presentations today.

I think you're in for a treat today. The two guest speakers who will address you later today are very distinguished, and even we adults in the transportation industry like to hear from them, as well.

I have a son in ninth grade, and I have a daughter in seventh grade, your age. They never cease to amaze me, from an academic standpoint. So I have no doubt that you will similarly impress us all today.

All of you will benefit from this learning experience, and if by chance, some of you grow up to work in the transportation field, then the rest of us will benefit from that. One thing I do know -- we will need the help of bright young people like you. Whether it's on highways, on bridges, whether it's in planning or high-speed rail, the transportation industry can be a very exciting field to work in.

I also would like to welcome the different schools that are here. John already mentioned that there are two classes from Redland Middle School In Rockville, Maryland. So welcome and congratulations to you. We also have a school from Tupelo, Mississippi, so welcome and congratulations to you, as well.

There are three schools participating from the State of California, and we're very proud that they are sponsored by three of our Caltrans districts. We have Monument Middle School from Rio Dell, California, which is in our District 1 area along the North Coast. Their liaison is Emma Cleveland. So welcome and congratulations to you, and thank you for being here.

We have Juan Crespi Middle School of El Sobrante, California, which is in District 4, in the San Francisco Bay Area. Our liaison with that school Is Alfonso Miles. And we also have Morada Middle School from Stockton, California, which is our District 10 area. Our liaison there is Marcella Anderson. So thank you very much to all of you for being here, and congratulations. We're very much looking forward to the presentations.

Ms. Maurillo: Thank you, Malcolm. We really appreciate your being here. Thank you very much.

Now we'll move into the program. Here is how we will manage the event. I will introduce each school in alphabetical order. So, first off will be Juan Crespi, then Monument, then Morada. After that will be Redland's first team, and then Redland's second team, and then, finally, we will have Tupelo. Each team will have up to 10 minutes to make their presentation.

If the Secretary of Transportation arrives during one of the presentations, we will continue on, but then we will interrupt at that point. Mr. Horsley will then introduce the secretary because, like I said, he's on a very tight schedule, so we have to accommodate him. Normally, he arrives after all the presentations are completed; but, in the event that he arrives a little bit earlier, then we will break, and allow him to speak. Then we will pick up with the presentations again after that.

I should let you know what the judges are grading on. They'll grade you not only on your presentation skills, but also on your teamwork – you know, how well you involve each other, and on the overall concept. So a perfect score is 150 points. Nobody has ever earned a perfect score yet, so that's something you can aim for. But you can earn extra points by asking and answering questions of each other after the presentations have been completed. I'll moderate those. So good luck to all of you, and let's start with the first team here in Caltrans District 4, Juan Crespi Middle School from El Sobrante, California. Alfonso, would you like to introduce the teacher, as well?

Mr. Miles: It's an honor and a privilege to introduce Gail Pavlich from El Sobrante, with Juan Crespi Middle School.

Ms. Maurillo: Thank you very much. Students, if you would like to go ahead and start your demonstration.

THE COMPETITION

Juan Crespi Middle School

Air-Flow-Rechargeable Car (ARC)

Female student: Good morning, ladies and gentlemen. I am Crystal Tse. Here is Jasmine Gill, Mayra Ramirez, Jasminder Pal, and Noel Ibarra. We have built an alternative-energy car. This car is an air-flow-rechargeable car, otherwise known as ARC. Our project is to recharge and lengthen the battery life of an electric vehicle while driving it by using wind energy derived from the vehicle's air resistance.

Female student: Our hypothesis is, if the friction produced from the air resistance on a moving vehicle is greater than the friction counter-produced from a wind turbine or air-flow energy-generating system, utilizing that friction, in theory, you should be able to produce energy that adds to that vehicle's battery life.

Male student: How this happens is, when a vehicle moves, it must use energy to overcome several components of friction. The more obvious types of friction a vehicle must overcome are tire and air resistance, but there is also the friction of moving parts, axles and gears, as well as the inertia of the car. We want to explore using wind generators located in the front of a vehicle, where most air resistance is greater when driving.

Male student: Why wind energy? When researching alternative energies for power production for vehicles, we couldn't find anything, with the exception of hang gliders and sails attached to the roofs of the cars, focused on this energy source. After several discussions, we came up with an idea.

Female student: In designing a wind turbine energy-generating system, the idea is to minimize the system's amount of friction, while optimizing the air flow through the wind turbines for greater energy-generating potential. What we don't want to do is add more friction from the wind turbines than the actual energy generated by the wind turbines.

Female student: For example, if you put wind turbines on the top or side of a vehicle, the wind turbines will produce energy, but not as much as the additional drag or friction, draining the battery to move the vehicle through the air.

The second law of thermodynamics will tell you that you cannot generate more energy from a system than the energy needed to power that system. So even if you are generating energy from your wind turbines, it will not be as much as the energy needed to move the vehicle through the air. You'll have a net loss of energy, so that won't be possible to use.

Female student: So why aren't we breaking the second law of thermodynamics with our project?

First, by placing the wind-turbine generators in front of the vehicle, where air resistance already exists, we are not adding any friction to the system. We are simply harnessing the lost potential energy and converting it to kinetic energy to recharge the battery.

Male student: Second, the wind generators would be in a tube slightly larger than the size of the wind-turbine blades. The tube would depend on the size of the blade, but the front of the tube would have a funnel slightly inset to the front of the vehicle to increase wind-surface area leading into the tube. The funnel would add a greater volume of air flow. The more air flow, the more RPMs, the more energy produced, while minimally increasing the friction in the system, if any.

Male student: And third, the main housing tubes would only be as long as the generator motor and the depth measurement of the turbulence (unintelligible) of our engine. The housing tube would open into a larger-diameter tube that would direct the air flow to the bottom of the car. The larger-diameter tubing, descending from the generator-housing tube, would create a lower pressure, helping air to repress the road-generating system much more efficiently, with less friction.

Female student: In addition, we're using very light-weight materials that help minimize friction, make the wind turbines spin at lower speeds, and achieve higher RPMs, producing more energy output.

Female student: Finally, not all motor generators can produce equally. Obviously, for the purpose of wind energy, you want the shaft of a generator motor to spin as effortlessly as possible to maximize the RPMs achieved by the motor. There are various moves. DC motors are our generators, but they are low-voltage. A typical 12-volt battery needs anywhere from 13.5 volts to at least 14 volts to recharge.

Female student: The current motors / generators that are smooth enough to use as wind turbines only produce a volt or two at 10 to 15 miles per hour. You would need 10 to 14 of them to make the recharging system work at lower speeds. At higher speeds, 20 to 30 miles an hour, you could maybe only use five wind turbines to achieve the volts and amps required to recharge the battery. Three volts from five wind turbines is 15 volts, more than the 14 volts needed.

Female student: Needless to say, it becomes a bit of an engineering challenge. The new DC brushless generators can generate some high voltage without the friction of the brush generators. It is conceivable to use 2- to 24-volt brushless generators to produce enough power at a lower speed to recharge the battery. This remains to be tested.

Male student: I think it's only fitting to quote Thomas Edison here. "Genius is 1% inspiration and 99% perspiration."

Disaster strikes twice. March 13, 2011: The 9.0 earthquake and [ensuing] tsunami occurs in Japan, and the West Contra Costa Unified School District denies the Juan Crespi Middle

School Alternative Energy Car Team the OK to use the electric powered ride-on dirt quad requested two months prior. Liability concerns. Project turned upside down!!!

Male student: Then, in February, the ARC team received their 32-volt brushless generators. All seemed very, very excellent. Five weeks later, four calls to the companies, two calls before the generator was even purchased, and we make sure it was the right product for the experiment. One physicist and two electrical engineers, and they worked 10 hours manipulating the two generators. Later. The verdict was in: They don't work. They don't even produce 30 millivolts at 3,000 RPM. No car and no generator.

Female student: So, five and a half months from when we began our attempt to look at an alternative-energy car, formulate a plan, spend hundreds of hours in research on the Internet, attending our weekly meetings, hear Ms. Pavlich go on about not defying the second law of thermodynamics for the 200th time, we have the little red remote control Hummer with a plethora of wind turbines on it to represent our tumultuous journey to get here, our relentless quest to keep searching for the truth, but most importantly, to keep our can-do team spirit.

Female student: The effort to assemble this aerodynamic disaster was quite a bit of work in itself. Getting the fans was quite difficult, and will be a challenge for the future projects. Our school had numerous broken overhead projectors that we salvaged for the fans. They work quite well. We also looked at pinwheels, which are very light-weight, and seem to work well, too.

To get the generators that we have, we had to manually hand-crank hundreds at different electronic stores in the "miscellaneous motor" bins to find the ones that had the smoothest spin to them.

Female student: Getting the motor / generators connected in a series using a diode to make sure the flow was one directional to demonstrate battery-charging was a major project by itself. Then we had to figure out how to mount the fans on the drive shaft, using different couplings, bar stocks, gaskets, Krazy Glue, and wherewithal to get it to work.

Male student: The future: The possibilities are endless. There is just too much to do. First, the plan is to obtain a remote-control car or make one that can drive from 50 to 20 miles per hour. It will then be fitted for a larger foundational chassis around 3 feet wide by 5 feet long, at which point a façade car can be built out of papier-mâché, wood, plastic, and whatever else it takes to test our ideas.

Male student: Second, there are several companies who manufacture the generators we are looking for, and although we had issues getting our desired generators, with the knowledge gained, we should be able to obtain them this time around.

Female student: Third, we would like to build a wind tunnel using Newton springs and a variable-speed fan to measure the different frictional forces on the car, and the wind-turbine blades. We can measure the pure air resistance of the front end of the car at different speeds, the air resistance with a hole cut out of the front of the vehicle, then the

air resistance with a static fan, then the air resistance with a moving fan hooked up to a generator. We could learn a lot from that information.

Female student: With the variable-speed fan, we could also have a tachometer to measure wind speed at RPMs, define optimum fan placements, and funnel shape and size.

Next, we want a fan with A, sound design, B, the airfoil exit speeds from the generator housing, and C, possible derivation or reduction to utilize higher-voltage generators.

Male student: Since air friction is a force which can be measured in Newtons, we can calculate the potential energy of the air resistance from a given vehicle. In classical mechanics, Newtons measured across the distance (Newtons times meter) is equal to one Joule, which is a unit of work. A Joule is a unit of power (work/time). One Joule a second is equal to one watt. In electrical systems, Watts are equal to Amperes (amps) times Voltage (volts). One amp is the rate of flow or current of electrons per second, and the volts are the potential energy difference or the pressure of the flow rate of the amps.

Male student: Or we can test a fully-charged battery on an operating car and note how long the battery lasts, and repeat this several times. All things being equal, the operating battery time of the car should be fairly consistent. Then put the wind-turbine generating system in place, and see if the vehicle operates for a longer time period. Repeat this several times to make sure. If it *does* work, we're onto something.

Female student: I remember hearing that birds should not be able to fly, but by developing collarbones, removing the mouthful of teeth, and replacing them with a lightweight beak, birds are amazingly lightweight for their size. Next, the curved upper surface of the wing design makes air flow faster above the wing than below the wing, creating low pressure over the wing. The difference in pressure above and below the bird's wing produces an upward force that causes the wing to rise. Birds do fly! It's about the engineering!

Female student: Finally, in closing, we'd like to paraphrase Al Gore from "An Inconvenient Truth." He stated that there will be no silver bullet to cure global warming, but small increments of improvement that add up to greenhouse reductions. Thank you for your time. We appreciate it.

Ms. Maurillo: That was Juan Crespi School from El Sobrante, California. Now we have Monument Middle School from Rio Dell, California.

Monument Middle School

Alternative Logical Gas Applied Energy (ALGAE)

Ms. Cleveland: I'm Emma Cleveland. I'm the sponsor of the Monument Middle School, and this is the seventh-grade science teacher, Miss Steiner.

Female student: Hi! I'm Nikki, and I'm your organizational leader from Monument Middle School's grass-roots organization, or "Alternative Logical Gas-Applied Energy." We believe we can make algae to fuel the future, and it is an efficient and clean-burning alternative for fossil fuel.

Female student: I'm Sydney and this is our environmental can filter.

Male student: Hi! I'm Noah, the science analyst.

Female student: And I'm Makayla and your economic advisor.

Ms. Steiner: We're waiting for the slides.

Male student: We're waiting for the slide show.

Female voice: We're having just a little bit of difficulty. We'll have our slide show up in just a moment.

Ms. Maurillo: Would you like us to come back? We can go over to District 10, and it will give you a few minutes to fix your PowerPoint problem.

Ms. Cleveland: That's probably a good idea.

Ms. Maurillo: Okay. Let's do that.

Ms. Cleveland: All right. Thank you, Donna.

Ms. Maurillo: It's no problem at all, Emma. We'll move over to District 10, Morada Middle School from Stockton, California. Are you ready? Are you able to come up and do your presentation while we're waiting for District 1 to fix their technical problems?

Morada Middle School

S S Morada Hybrid Vehicle

Ms. Anderson: Good morning, Donna! Yes, we're ready!

Ms. Maurillo: Okay, Marcella. Would you like to introduce your school, please?

Ms. Anderson: Thank you so much! My name is Marcella Anderson. Please allow me to introduce the class of Morada Middle School.

Ms. Lovick: …Good morning, everybody! Our team is proud to present the SS Morada Hybrid Vehicle. I am Breyana Lovick, the project manager.

Mr. Lowe: I am Damani Lowe, the electrical engineer.

Ms. Hernandez: I am Denise Hernandez, the transportation engineer.

Mr. Cahill: I am Andrew Cahill, the co-project manager.

Mr. Rillamas: I'm Jimmy Rillamas, the process engineer.

Mr. Flippen: I'm the budget manager, Enrique Flippen.

Ms. Lovick: By now, you may notice many social, environmental, and economic issues related to transportation, issues such as air quality, global warming, and climate change. Today, researchers and social scientists are looking at many consequences of our dependence on fossil fuels. Approximately 30,000 people die every year in the United States because of pollution-related causes.

The burning of fossil fuels causes carbon dioxide and other emissions to be released into the atmosphere. In addition to this, more than half of the people living in the U. S. live in areas that fail to meet federal air-quality standards. Next, our co-project manager, Andrew, will continue this presentation on these issues.

Mr. Cahill: Thank you, Breyana. Fossil fuels are not a sustainable fuel source, as they are never renewable, and as current reserves will eventually be completely depleted. While it is unknown exactly when fossil-fuel reserves will be depleted, the rapid use of fossil fuels around the world will only speed up this process, as depletion will surely occur.

Equally important, the impact of global climate change may only worsen without a decrease in the use of fossil fuels, and the ecosystems around the world will continue to suffer as long as fossil fuels continue to be heavily used. Next, our transportation engineer, Denise, will go over the objectives of the project.

Ms. Hernandez: Thank you, Andrew. There are four primary objectives to our project. They are as follows.

Our first objective is to enhance the earth's environmentally friendly system. A sustainable transportation system should do more than use sustainable and replaceable fuels. These fuels should also have the least amount of negative impact to the environment.

The second project objective is to identify and use sustainable fuel sources that will cause less pollution. Not only are fossil fuels irreplaceable, these types of fuels will only worsen the environment and the lives of all living things as long as they are around.

Our third objective is to develop a form of transportation that is affordable and efficient. In order to work well, everyone using this transportation system will use it at a cost that can be afforded by everyone. Also, for this transportation to work well, it must produce minimal waste so that it will result in a highly-efficient way of travel.

Our fourth and last project objective is to improve transportation safety. Improving safety in a transportation system can only mean an improvement in how well this transportation works.

Safety is and will be at a high priority in transportation if everyone using a transportation system is to leave their origin and arrive at their destination in the safest way possible.

Next, our project engineer, Enrique, will discuss biodiesel, which is the primary energy source of our vehicle.

Mr. Flippen: Thank you, Denise. Our project will use biodiesel as the primary energy source. Well, what is biodiesel? Biodiesel is a renewable and sustainable energy source made from new or used vegetable oil. It is used only on standard diesel engines. For your information, a standard diesel engine is an external combustion engine that uses highly-compressed hot air as the ignition, which differs from the spark ignition being used in gasoline engines. The use of biodiesel produces less pollution than fossil fuels. As an example of the use of biodiesel in our current society, it can be used to provide heating for homes and buildings.

Next, our electrical engineer, Damani, will discuss in more detail how we're going to use electromagnetism and rotational motion in our project.

Mr. Lowe: Thank you, Enrique. In addition to biodiesel, we will be using electromagnetism and rotational motion to produce electricity. Electromagnetism is the practice of a magnet moving through a coiled wire to produce electricity. Rotational motion may be used with the idea of electromagnetism to produce electricity. Both of these ideas can be used together to produce an electrical energy source. In current applications, using the combination of electromagnetism and rotational motion are crank radios and mechanically-powered flashlights.

Next, our process engineer, Jimmy, will discuss in more detail how sustainable energy sources will be implemented in our project.

Mr. Rillamas: Thank you, Damani. There are three steps to implement the use of these sustainable energy sources in our SS Morada Hybrid Vehicle.

First, biodiesel will be used as the vehicle's primary energy source, derived from used and new vegetable oil. Second, the vehicle's wheels will be equipped with specially developed magnets and coiled wires that will create electricity and charge a set of batteries. When batteries are charged, the driver of the vehicle has the option to switch to electric power created by the electro-magnetic development of electricity.

Now, the production manager, Breyana, will talk about some additional safety features that we have considered as a key for the development of our project.

Ms. Lovick: Thank you, Jimmy! We recognize that safety is our priority, and we have implemented some additional safety features to our SS Morada Hybrid Vehicle. Our vehicle will have an adjustable force field of magnets that will be incorporated into the body of the car and controlled by the car's computer system to regulate collision-reduction. In the event that two vehicles may collide, both vehicles will engage magnet force fields to repel

each other and avoid any collision. Lives may be saved and injuries and property damage may also be reduced.

This is our demo video. This simple visual demonstration of the project shows our vehicle, the SS Morada Hybrid, moving along the road.

Now our budget manager, Enrique, will talk about the affordability and value of this vehicle.

Mr. Flippen: Thank you, Breyana. One of the questions that may arise is how Americans can afford this vehicle. Oil and gasoline prices have risen to their highest level in two years, and analysts say prices could shoot up dramatically this year as the thirst for fuel grows in the U. S. and around the world. The gasoline crisis is real, and it is impacting many aspects of our actual society.

Gasoline is currently approaching over $4 per gallon in the U. S. Commuters are spending more than $300 per month for gasoline. Our team has estimated that the use of electromagnetism and biodiesel in this vehicle over time will eventually pay the cost of the vehicle itself.

After much consideration, the following recommendations are made to this audience.

First, the development and use of biodiesel as a sustainable fuel source.

Second, the use of electromagnetic systems to produce electricity as an energy source.

Third, it is key to implement the use of variable electromagnetic force fields to reduce loss of lives, injuries, and property damage.

Our co-project manager, Andrew, will conclude this presentation.

Mr. Cahill: Thank you, Enrique. The conclusions that came up for our project are as follows:

Sustainable energy sources need to be developed and implemented to reduce or eventually eliminate the use of fossil fuels.

Electromagnetic-produced energy sources should be developed and implemented to enhance safety in renewable energy sources.

Thank you for this opportunity and your time to participate in the Garrett Morgan program.

Ms. Maurillo: Thank you very much, District 10. Let's move to District 1. Are you ready to do your presentation?

Female voice: Yes, we're going to start from the beginning again.

Ms. Lee: Hi. I'm Nikki, and I'm your organizational leader from Monument Middle School's Grassroots Organization, or Alternative Logical Gas Applied Energy. We believe we can

make algae the fuel of the future and as an efficient and clean-burning alterative for fossil fuel.

Ms. Harralson-Pease: Hi. I'm Sydney, and I'm the environmental consultant.

Mr. O'Kelly: Hi. I'm Noah. I'm the science analyst.

Ms. Sancho: I'm Makayla. I'm your economic advisor.

Female student: Algae fuel is a biofuel. Algae fuel is also clean-burning and efficient to our environment. Algae is a renewable energy source and is available in almost all parts of the world. Algae has to have sun, humidity, and water to grow. Algae can grow in the ocean, rivers, lakes, streams, or swamps. It can also be a farmland crop. Algae can grow best in places like the Central Valley or, an even better example, here in Humboldt County.

Algae is known as a biofuel. Algae oil can become economically accessible and the green waste left over from the extraction can be used to produce a type of gas named butanol. It produces 300 times more oil per acre per year. It requires a modified diesel engine, and the engine would need to be cleaned regularly to prevent algae buildup.

Male student: Algae is a fuel alternative and can be made into alcohol for Ethanol or a biomass that can be burned. In order for it to work, you'd need an area 1.3 times bigger than Belgium to produce enough fuel for the U. S., but that's less than one-seventh of the corn farmland the U. S. uses. The carbon dioxide from the algae power plants would be captured and used to provide food for the algae plants.

Female student: Now we are gong to demonstrate how to produce and harvest algae fuel. The first step in having your algae processor is having your algae setup ready. You can do it in a home setup.

Female student: Or in a lab.

Male student: Like that one right there.

Female student: You can mix fertilizer with water to experiment on how fast the algae would grow.

Female student: Algae has to have sun in order for it to grow.

Male student: It can grow in back yards, window sills, or under an ultraviolet light.

Female student: The first step is scooping algae out and putting it into a filter.

Female student: Then you would press out all of the excess water.

Female student: Next, you place the algae on a tray like this, and spread it out.

Female student: You can set the tray…under a window sill or outside to dry. Once it's dry, you would grind it to a power like this, and use that for fuel.

Male student: Or, to extract the oil, you can juice or press the algae and store it in a sealed container like that

Female student: And 10 grams of algae produces 3 grams of fuel.

Female student: Algae would be around $2 a gallon, headed towards $1. Algae produces 1,000 gallons of algae per acre per year.

Female student: Algae oil would be priced at $102 to $100 a barrel.

Female student: Algae produces 50 million gallons a year.

Female student: Algae fuel is more efficient and cleaner than fossil fuels. It costs $2 a gallon, headed towards $1, when regular gasoline costs you around $4. Algae gas gives you 150 miles per gallon of gas. Algae fuel is non-polluting and fossil fuels are very polluting to our earth. Algae is available almost everywhere, and does not damage the earth, as opposed to fossil fuels, which create acid rain and hurt our ozone layer.

Female student: Algae is a lot harder to produce than regular fuel. Algae has an extremely tough cell wall for breaking down into fuel. Algae fuel would need a specially-modified diesel engine, and algae cannot grow year-round in certain places because of its needs, such as heat or humidity.

Female student: Algae does not affect fresh-water resources. It can be produced using fresh water, ocean water, or waste water. Algae is biodegradable and it's harmless if spilled, unlike fossil fuels. It uses its source of natural deposits and the green waste left over from the extraction can be used to produce butanol. It can produce more algae in an area the size of a two-car garage than a football field of soybean oil.

Female student: And algae is extremely efficient and gets you 150 miles per gallon with an electric hybrid. Without a hybrid, you would get about the same mileage as a regular vehicle, if not a little more.

In the top-left corner is an example of how much excess algae our earth has. With algae fuel, you'd be taking all that algae away, leaving space for other things that we need.

In the top right corner is our acronym, which is Alternative Logical Gas Applied Energy; and, in the bottom left corner is butanol. As we said, it is a type of fuel made from the leftovers of the algae extraction.

In the bottom right corner is algae – microscopically close.

Female student: This is the conclusion to our algae presentation.Thank you for time.

Ms. Maurillo: Thank you very much, District 1. That's wonderful. Now we're going to move across the country to Washington, D. C., and we will hear from Redland Middle School's first team, from Rockville, Maryland. Would you like to introduce your team, please?

Redland Middle School Team 1

The Bullet Train Over the Years

Male student: Good afternoon. I would like to thank our sponsors, the American Public Transportation Association, Ms. Cheryl Pyatt, and vice president Pamela Boswell. We would also like to thank Miss McLurkin, our teacher, and our principal, Mr. Robert Sinclair, for their support.

The Bullet Train Over the Years by Valerie Backley, Jonathan Backley, and Alana Harris.

Hideo Shima was the mastermind of the bullet train.…He was a Japanese engineer who designed and supervised the construction of the world's first high-speed train. The Shinkansen was launched in 1964 to coincide with the Tokyo Olympics on October 1, 1964. The same day, it inaugurated throughout (audio cuts out) Olympic athletes, two bullet trains left simultaneously from Tokyo and Shin Osaka stations. They traveled at 222 kilometers per hour, and helped elevate Japan to the ranks of the world's most technologically advanced nations.

In November 2000, U. S. voters supported financing a bullet train. In October 2003, ridership for the bullet train rose slightly more than 3 percent, thanks to improved schedules and the October 2003 opening of a bullet-train station in Shinagawa, a Tokyo business area.

The first bullet train designed and manufactured with a speed of 300 kilometers per hour rolled off the production line on December 22, 2007. The train was the lastest model in the country's China Railway High (unintelligible). This marks that China has joined the elite world club after Japan, France, and Germany, to become the fourth country capable of such high-speed trains. It is time for the United States to get on board the bullet train.

There are many different types of bullet trains in the world. For example, the Germany ICE (inter city express), the TGV (Trains à Grande Vitesse) in France, the American Flyer, and last but not least, the Shinkansen in Japan. The fastest bullet train is the TGV at 322 miles per hour. The slowest bullet train is the American Flyer, at 140 miles per hour. Bullet trains have special tracks that no other train can ride on. Bullet trains' plans are almost entirely based on aerodynamics. While most trains run on coal or diesel fuel, these don't. Bullet trains run on electricity. They use electricity so they can go much farther distances without needing to refuel or stop a lot.

Female student: The federal government in December 2010 redirected $624 million in economic-stimulus funds from other states to the California High Speed Rail project, bringing the total available for building the line to about $5.5 billion. Michigan has received $161 million for a high-speed path that connects Detroit to Chicago. Iowa received $230 million for a new intercity rail link from Iowa City to Chicago. According to the U. S. Department

of Transportation, $715 million will help pay for the design and construction of a section of the planned bullet train in the Central Valley. An additional $16 million was earmarked for the high-speed rail corridor between San Francisco and San José.

Female student: TI-AL-SOL Bullet Train. Our ideas for improvement on the bullet train are using alloys that are light yet strong to create an outer shell on the bullet train, and also using solar energy to power the bullet trains.

What is Ti-Al? TI-Al is shorthand from titanium aluminum. This alloy is lightweight for its size. Ti-Al also has a very thin layer of their oxides on the surface, which stops air and water from getting to the metal, Ti-Al resists corrosion. This is good because if Ti-Al is used to make the outer shell in the bullet train, then it would be lightweight and resist corrosion if rain happens to get on the bullet train.

Aluminum itself is already used for aircraft, trains, saucepans, cooking foil, and etc. If you ever have tried to pull apart a sheet of aluminum cooking foil, then you realize it may look lightweight, but it is very strong, and very difficult to pull apart.

Titanium itself is already used for fighter aircraft. These two elements combined together, Ti-Al, would be incredibly powerful yet light.

Female student: Solar energy. Imagine a bullet train zooming across its tracks. It's using no electricity to power itself. How is this? Solar-energy panels would be placed above the bullet train and its tracks to capture the sun rays and convert them into enough energy to power the bullet train in order for it to run along the tracks.

If there were to be a bullet-train track connecting two major cities across the United States, such as San Francisco to New York City, then it would be phenomenal to be able to take a bullet train powered by solar energy as a method of transportation. The bullet train can pass through hot spaces such as Arizona and New Mexico, and get the sun's rays to power up the bullet train. States that also happen to be sunny will help provide the bullet train with its energy as it zooms to NYC from San Francisco. If it's a rainy day, no worries! Solar energy can be stored for later use. Plus, if the bullet train passes through sunny states like Arizona, then there should be solar energy for the train to be powered. Solar energy versus electricity is a more greener way to go about how bullet trains should be powered. Thank you.

The bibliography we used: inquest.org, articles.latimes.com, and money.cnn.com. Thank you.

Ms. Maurillo: Thank you very much, team 1. Redland Middle School in Washington also has a second team. Would you like to introduce them, please?

Redland Middle School Team 2

Transport Planners

Mr. Eshetu: My name is Nati Eshetu, and my partner here is Madiba Massey. We have done research on Transport Planners. Transport Planners by Madiba Massey and Nati Eshetu.

Mr. Massey: A transport planner predicts travel patterns, taking into account environmental and social aspects of road transport. The goal of a transport planner is to promote the use of public transit by making it a more convenient and reliable option for commuters. A transport planner helps improve public transport in several ways, including conducting studies of existing transport systems, creating surveys to gauge rider experience using computer software to simulate the effects of new methods of public transportation.

Mr. Eshetu: Education requirements. To be a transport planner, you would need a bachelor degree within these courses: engineering, geography, city planning, mathematics, and geographical information systems.

Mr. Massey: According to a salary site (gives URL for web site) $40,000 through $60,000 per year is what is estimated a transport planner makes. The salary can also depend on education and experience. The salary can also be raised if you have a graduate degree.

Mr. Eshetu: The Challenges Faced for a Transport Planner. Air quality, congestion management, financial planning and programming, land use, performance measures, safety and security.

Mr. Massey: Here are some…famous transport planners over the years. One was Professor Sir Colin Buchanan. He was a British town planner born in 1907 in Simla, India. He published *Traffic in Towns* in 1963. *Traffic in Towns* presented a comprehensive view to the issues surrounding the growth of personal car ownership and urban traffic in the UK.

Another famous transport planner is Isambard Kingdom Brunel. He was born in 1806 in Portsmouth, England. He was a railway engineer, and he designed methods that are still used today in high-speed trains. Brunel also worked on designing docks, viaducts, tunnels, and various other structures.

There was also a man named Appius Claudius Caecus. He was born in 340 BC in Rome. He was a Roman politician from a wealthy patrician family, and was a consul, and built the Appian Way.

Mr. Eshetu: For reference, we used several web sites such as transit.com, wikipedia and wikiengineer. (applause)

Mr. Massey: Thank you for your time.

Ms. Maurillo: Thank you very much. We will continue in Washington, D. C., with Tupelo Middle School from Tupelo, Mississippi. Would you like to introduce your team, please?

Tupelo Middle School

The Nguyen Bus

Ms. Smith: Good morning! My name is Julia Smith, and I'm the teacher sponsor for the Nguyen Bus team. First of all, I'd like to thank the Mississippi Department of Transportation and AASHTO for being our sponsors. And I will turn it over to the boys. Thank you!

Mr. Lee Nguyen: Welcome, ladies and gentlemen. My name is Lee Nguyen, and that's Austin Nguyen. There are many problems in the world today, but one of the leading problems is the use of gasoline. This is because gasoline can cause smog, air pollution, global warming, and economic issues.

Mr. Austin Nguyen: Another problem is that the gas prices are going up. Our solution is to use the Nguyen Bus, a bus that runs on methane and solar energy.

Mr. Lee Nguyen: Gasoline-burning vehicles have a huge effect on the problems that I have just listed, like smog, the greenhouse effect, and economic issues. Gasoline releases carbon dioxide, nitrogen oxides, and nitric oxides, which are all very harmful to us as humans and the U. S. and the environment. What's worse is that the U. S. uses an estimated 137.93 billion gallons of gasoline every year.

Mr. Austin Nguyen: Smog is created when gasoline is not burned. In the 1950s, a new type of smog called photochemical smog was formed. Photochemical smog is created when sunlight, nitrogen oxides, and (unintelligible) chemically react. Photochemical smog is very harmful to children, senior citizens, and people with lung and heart diseases.

Mr. Lee Nguyen: Carbon dioxide. This is a major pollutant released by the use of gasoline. It is also a toxin that traps a lot of heat in the atmosphere.

Nitrogen and nitric oxides. Nitrogen oxides are released when nitrogen and oxygen react under high temperatures such as in the exhaust of cars. Nitric oxide is another name for carbon monoxide, which is very deadly to humans. One whiff of it can kill you. Nitric oxide works by binding to your hemoglobin and taking up all your oxygen-binding sites, which cause you to suffocate.

Mr. Austin Nguyen: Methane. This is cheap, efficient, and environmentally friendly. Methane can be found anywhere, including underground pockets and human and animal waste. Methane leaves no residue in the engine, therefore making the engine last longer. Methane costs 67 cents per gallon, while gasoline costs $3.45 per gallon. A methane facility would cost $50 million, while an oil refinery would cost $80 million to $120 million.

Methane is the leading greenhouse gas that is heating the atmosphere. We're going to take the methane from the atmosphere and use it in a positive way.

Solar energy. Solar energy is renewable, rechargeable, and also environmentally friendly. While you use your methane during the day, the solar panels will be getting solar energy, so if you run out of methane, you have the backup solar energy.

Mr. Lee Nguyen: How the Nguyen Bus would work. The methane tank would replace the gas tank, and be transported to the carburetor of the car using a few tubes. You can also add a bay carburetor to the car, a bay carburetor attachment to the carburetor, to make the car run more smoothly.

The solar panels would go on top of the bus and be hooked up to the battery, so you wouldn't lose any interior space. All the solar panels would cost only $1,725 and add only 129 pounds. You can also make your own methane at home using a water-heater tank, straw for carbon, manure or waste, and tubes to get the methane to the bottle, and it should only cost about $300. This process is called anaerobic digestion. Anaerobic digestion is when anaerobes are starved of oxygen, causing them to break down biodegradable material to make the methane.

Mr. Austin Nguyen: As you have heard, there are many issues caused by gasoline such as smog, air pollution, and global warming. Thank you for listening and have a great day. (applause)

Ms. Maurillo: Thank you very much. Those are all of our teams today. John Horsley, has the secretary arrived yet?

Mr. Horsley: He's not outside the door. Let's do the Q&A.

QUESTION AND ANSWER

Ms. Maurillo: Okay, great. We'll start with that. First, I will go down the list in alphabetical order, and I will ask each school to ask a question of one of the other teams about their project. You receive one point for each question or answer, and that gets added to your score. And when the secretary arrives, we will interrupt. We allow him to address you, and then we will continue on afterward. Okay?

So first I would like to call on Juan Crespi Middle School. Do you have a question for one of the other teams? (Discussions aside) Would you like me to go on to the next school?

Juan Crespi Middle School, female student: What do you guys think? Yes, can we wait?

Ms. Maurillo: I can come back. Does Monument Middle School have a question for any of the other schools?

Q: (**Monument Middle School, female student**) For Redland Middle School, how many solar panels would it take to power the bullet train?

Ms. Maurillo: I will repeat the questions. Redland Middle School, how many solar panels would it take to power the bullet train?

A: (**Redland Middle School team 1, male student**) Twenty. (laughter)

Ms. Maurillo: Twenty. Okay. Morada Middle School, do you have a question for one of the other schools?

Q: (**Morada Middle School, male student**) Yes. This is for Redland Middle School, team 2. What is your main goal or objective in achieving sustainable transportation?

A: (**Redland Middle School, team 2, male student**) Our main goal is be green.

Ms. Maurillo: The main goal is to be green. They have a little bit of a sound problem. Redland Middle School, first team, do you have a question for any of the other teams?

Q: (**Redland Middle School, first team, female student**) I have a question for the team that's using algae. If you're using algae, wouldn't there be a shortage of marine life?

A: (**Monument Middle School, female student**) No. It doesn't affect fresh-water resources or the wildlife.

Ms. Maurillo: Tupelo, do you have a question for a school?

Q: (**Tupelo Middle School, Lee**) We have a question for the team that's using algae as a fuel source. How do you use the powder as a fuel?

A: (**Monument Middle School, male student**) It burns in the engine.

Q: (**Tupelo Middle School, Lee**) How would you store it?

A: (**Monument Middle School, male student**) In a modified diesel engine, just like a regular fossil-fuel tank.

Q: (**Tupelo Middle School, Lee**) And I have a question for the team that is using the wind turbines.

Ms. Maurillo: We go around in alphabetical order, and I can come back around again. Each team gets one question each turn, okay? We can come back to you. Juan Crespi, do you have a question for any of the other teams?

Q: (**Juan Crespi Middle School, male student**) Yeah. What happens if you run out of algae when it's running?

Ms. Maurillo: What happens if you run out of algae when it's running?

A: (**Monument Middle School, female student**) You would break down just like a regular car with gasoline.

A: (**Monument Middle School, female student**) It's just like fossil fuels, only cleaner.

A: (**Monument Middle School, male student**) And more efficient.…

Ms. Maurillo: Monument, do you have a question for another school?

Q: (**Monument Middle School, female student**) I have a question for Tupelo. How many miles per gallon could it get you on a gallon of gas?

A: (**Tupelo Middle School, Austin**) Just as much as regular.

Ms. Maurillo: Morada, do you have a question for another team?

Q: (**Morada Middle School, male student**) Yes. I have a question for Monument Middle School. How long would it take to create an algae fuel source at your home?

A: (**Monument Middle School, female student**) It would only take like one to ten days to grow, and then you can create the gas.

Morada Middle School, male student: Thank you.

Ms. Maurillo: Okay. Redland, team 1. Do you have a question for another school?

Q: (**Redland Middle School, team 1, female student**) I have one more question for Monument Middle School doing the algae, if I'm correct. How would you know when you run out of algae in your car? Would it be like a meter?

A: (**Monument Middle School, female student**) It's exactly like regular gasoline, so you would still have the speedometer-type thing in front of your dash**.** It runs off oil made from algae.

Ms. Maurillo: Okay. Redland second team, do you have a question for another school?

Q: (**Redland Middle School, team 2, female student**) As a matter of fact, I do. I have a question for the first school. If you were making cars like that, how fast do you think your production would be?

Ms. Maurillo: How fast do you think your production would be?

Q: (**Redland Middle School, team 2, female student**) Yeah, like how fast would you go with these kind of wind-turbine cars?

Ms. Maurillo: (after discussion) You can ask them to clarify.

Juan Crespi Middle School, female student: Can you clarify the question?

Q: (**Redland Middle School, team 2, male student**) I mean, would you think that it would be a popular car? People would like it? It would sell? Sell a lot?

A: (**Juan Crespi Middle School, female student**) We hope so!

A: (**Juan Crespi Middle School, male student**) Plus we have an engine that saves energy.

A: (**Juan Crespi Middle School, female student**) We do think it would be a popular car.

Ms. Maurillo: Tupelo, do you have a question for one of the other teams?

Q: (**Tupelo Middle School, Austin?)** I've got a question for the first team. How would the vehicle get past height restrictions? Wouldn't it be too tall to go anywhere?

A: (**Juan Crespi Middle School, female student**) Well, the big fans that you see, the multi-colored fans? We won't really use those. We'll mainly use like the computer fans. They're little. They're in the front of the car. And those would be placed in front of a car.

Mr. Horsley: Donna, the secretaries are now here.

Ms. Maurillo: Okay, great! John, would you please introduce the secretary? Is Secretary Mineta also there?

Mr. Horsley: Yes.

Ms. Maurillo: …You have the stage!

Remarks by Mr. Horsley, Secretary Mineta, and Secretary LaHood

Mr. Horsley: Thank you. It's my great honor to introduce Norm Mineta, a former secretary of transportation, the former mayor of San José, a distinguished member of Congress, and the former secretary of commerce, and he will introduce Secretary LaHood, and I want both secretaries to know that we have had six competitors, three teams from California, two teams from Maryland, one team from Tupelo, Mississippi, who have made amazing presentations on sustainable transportation. We've heard about how to make a U. S. bullet train using advanced materials to go faster, solar-power buses, the use of methane gas, of a windmill-powered car, and the use of algae for fuel. So we've got some great advanced technologies. Secretary Mineta, I'd like to ask you to introduce Secretary LaHood. (applause)

Secretary Mineta: John, thank you very much for your leadership of the American Association of State Highway and Transportation Officials. Indeed, this is the organization, made up of all the state transportation officers in all 50 states, and so they work very closely with the Department of Transportation. And it is my great pleasure to introduce to you a very good friend of mine who, as a member of Congress, worked for Congressman Tom Railsback as his chief of staff, and was the highest-ranking bat person for Congressman Railsback, and then became the chief of staff for Congressman Bob Michel, who was the Republican leader in the House of Representatives, and both very, very distinguished people, and did great work in Congress.

I'm quite sure, then, our secretary of transportation learned a great deal about being a member of Congress from Congressman Tom Railsback and from leader Bob Michel. And so, when leader Michel decided to step down, then Mr. LaHood ran for his Congressional seat, and served in the Congress for, let's see – 1992, when he was elected, to – 14 years. A very distinguished career; but, more importantly, he was always picked by the leadership of Congress to sit in the chair of the House of Representatives to chair major bills. Now, when you do that, you have to know your parliamentary rules, recognition of members as they stand to get recognition to speak on the floor, and they knew that, in Congressman Ray LaHood, they would always have a senior but, more importantly, a capable individual who was chairing the House of Representatives.

And then President Obama gets elected, and he then chooses Ray LaHood, a Republican, to become a member of President Obama's cabinet as the secretary of transportation. Now I'd like to think that maybe, as chairman of the public works and transportation committee when Congressman LaHood was first elected and came on our committee, that we trained him well to become secretary of transportation, but he's a very bright man. He picked it

up on his own, and with his own leadership capabilities. Today, he is the 16th secretary of transportation, doing a tremendous job for this great country. So it is my honor at this point to introduce to you Secretary Ray LaHood, Secretary of Transportation. (applause)

Secretary LaHood: Well, welcome, everybody! It's wonderful to have you all join us. John, thank you for your leadership, and certainly, to former Secretary of Transportation and former Secretary of Commerce, and former Congressman, Norm Mineta, thank you for all your leadership in so many ways. Really, your public service has been outstanding for our country. Norm has been spending the last few weeks trying to help Japan by raising money from around the country for the terrible disaster that happened there, and taking time away from his busy schedule to do that, and that's quite extraordinary.

We're so delighted that you're here at DOT and delighted to have a chance to say a word or two about a few of the things that we're doing. We've been very active for the last two-plus years that President Obama has been in office in trying to start a high-speed rail program in America.

And what I mean by that is, we have some trains in certain parts of the country, like on the Northeast Corridor, trains that run between Washington and New York and Boston, even some Amtrak trains that run around the country. But we don't have the kind of trains that they have in Europe or Asia, the kind of trains that go fast. The kind of trains that really connect all of Europe, and connect all of Asia. That's what President Obama's vision is – to have an opportunity for Americans to be able to get on a train and go anyplace they want to be able to go, like you're able to get in your car and drive wherever you want to drive to

today. And so the President has used high-speed rail as a real strong initiative, over the next 25 years, to connect 80 percent of America.

Today, America is connected by a very strong interstate system, and we know that that system took 50 years to build, and a lot of taxpayer money to do it. We want to get to the same place that we're at in America with high-speed rail as we are with our highways. So we have a lot of people around here working on that.

I just came from Georgetown University, which is in Georgetown, nearby here, and the President gave a speech there about energy. If you were an owner of an automobile, which someday you will be, you know that gasoline is very high right now. It's the highest in California, but it's also high everywhere in America, and the President is talking about, "How do we really get our country moving in the direction so that we can have more cars that are hybrid -- battery-powered plus combustion?" Some cars are totally battery-powered. How do we get the idea that people use other forms of transportation, like buses? Like streetcars? Like a light-rail system?

In this city, in Washington, D. C., you can live here without an automobile, and many people do, because there are all forms of transportation. In America, people have to pay high prices for gasoline. That really hurts the family budget. The second-highest cost for people in America is transportation, in many different forms. So the President is working very hard to develop energy ideas about how we don't always have to rely on oil and gasoline to fuel the vehicles that we drive.

The other thing I want to do is encourage you to think about transportation as opportunities in the future. There are many wonderful opportunities in transportation, and I know that part of what you're participating in gives you a feeling about transportation and other opportunities that may come from that. So let me stop here and see if you have some questions that you would like to ask me. We can have a discussion about anything that you'd like to talk about.

Q&A – Secretary LaHood

Ms. Maurillo: Mr. Secretary, would you like to go in alphabetical order with the schools? Or would you like them just to raise their hands and ask questions?

Secretary LaHood: Let's go alphabetical order.

Ms. Maurillo: Okay, great. Juan Crespi Middle School, would you like to start? Do you have a question for the secretary?

Juan Crespi Middle School, female student: Can you ask him anything?

Ms. Maurillo: Yes. You can ask anything you want.

Q: (**Juan Crespi Middle School, male student**) Have you already met Obama?

Ms. Maurillo: Have you already met President Obama?

A: (**Secretary LaHood**) Well, I was just with President Obama at a university here in Washington, D. C., where he gave a speech about energy, about high gasoline prices, about how we can really think about other forms of transportation other than just automobiles. We had a big group of people there that heard the President's speech, and it was broadcast around the country, and probably around the world.

I met the President some time ago when he and I were both members of Congress. Then he got elected President, and he invited me to serve in his cabinet. So we have many opportunities to see the President, listen to him, and also be a part of President Obama's team around the idea that transportation is very, very important, and helping the President carry out his transportation agenda.

Ms. Maurillo: Thank you, Mr. Secretary. Monument Middle School, do you have a question for the Secretary? You can ask anything you like.

Q: (**Monument Middle School, female student**) Yes, we have a question. Do you have ideas or projects for sustainable fuel sources?

A: (**Secretary LaHood**) We are working with other people in the administration on sustainable fuels. We are working—certainly, the people in agriculture are working—very hard on opportunities for wind energy. People in the energy department are working on solar and wind energy. The entire administration is trying to find opportunities for sustainable energy, whether it's solar, whether it's wind.

Obviously, there's a huge debate going on in the world about nuclear energy. We have a lot of nuclear power plants in our country, which is very clean-burning. Doesn't put any CO_2 in the air; but we know what's happened in Japan with the power plant, and where it was impacted by the earthquake that took place there, and so there is a big debate in the world about nuclear energy. In his speech today, President Obama talked about how do we really create opportunity for more sustainable energy? And that's a very important item for the President. He's talked a lot about wind energy, solar energy, nuclear power, and other opportunities to power automobiles, but also to power the grids that provide the electricity and other energy. Natural gas is another form of energy that the President has discussed. Any form of energy that will take CO_2 out of the air, clean the air up, and make it cleaner for the environment.

Ms. Maurillo: Thank you, Mr. Secretary.

Female student: Thank you.

Ms. Maurillo: Morada Middle School, do you a question for the secretary?

Q: (**Morada Middle School, male student**) Yes, we do. I would like to know how a student like me can become Secretary of Transportation. (laughter)

A: (**Secretary LaHood**) That's very interesting because, as a result of you participating in this magnificent program, this very innovative program, that you will think about occupations and vocations and opportunities for employment at the Department of Transportation. I hope I will become smart enough and more qualified for this position before I leave it. But if you continue to do your part and work hard, that's the first step.

You have to have a good education, and you have to have an interest in transportation, and you have to have a good understanding of not just rail or buses or cars. You have to have kind of a complete understanding of transportation, a complete realization that transportation involves planes and trains and motor coaches and school buses and automobiles and so many other forms of mobility. There are so many facets to transportation. The first step is really to continue your studies. You are participating in a great program now. Continue your interest. Continue your studies.

The other little piece of it that is not taught is the way that Mr. Mineta and Mr. LaHood got these jobs. We were involved in politics. So you can be the smartest person in the world. Actually, you could be smarter than Secretary Mineta or Secretary LaHood in transportation, but you must have that little set of politics that goes along with it. We got our jobs because of our interest in transportation, our knowledge of transportation, but also because we were involved in politics.

Actually, Secretary Mineta was appointed as a Democrat in a Republican administration, and I was appointed as a Republican in a Democratic administration. So it doesn't have to be partisan politics, but there is a little bit of politics involved in it, too. So you have to be smart. Study hard. Get some good knowledge about transportation. Get involved in some transportation. But also, in order to get this job, there has to be a little mix of politics involved in it, too.

Ms. Maurillo: Thank you, Mr. Secretary. Redland first team, do you have a question for Mr. Secretary?

Q: (**Redland Middle School, team 1, female student**) Do you drive a hybrid?

A: (**Secretary LaHood**) The question is, do I drive a hybrid? Yes, I do. I live in Peoria, Illinois, right in the middle of the country. And Peoria is right in the middle of Illinois, about 140 miles from Chicago, and it's about maybe 150 miles from St. Louis. So it's right in the middle of the state. The car that I have in Peoria is a Ford Escape Hybrid, so it's part battery-powered, and part combustion. So we feel like we're doing our part for the environment. Thank you.

Ms. Maurillo: Great! So you walk the walk! Okay. Redland second team, do you have a question for the secretary?

Q: (**Redland Middle School team 2, female student**) Yes, I do. Do you think the gas prices are going to go down anytime soon?

A: (**Secretary LaHood**) Do I think gas prices are going to go down any time soon? No, I don't, because I think there's so much turmoil in the Middle East. Even though most of our oil that makes gasoline comes from Canada. They're the number-one supplier for us. A lot of oil does come from the Middle East. And when there's turmoil in the Middle East, it causes gasoline prices to begin to go up because refineries don't have the same access in terms of their ability to have the kind of production of oil in some of these countries. I think most people think that the majority of our oil does come from the Middle East. But actually, it comes from Canada and places in South America, and then the third-largest place is the Middle East.

I think gasoline prices are going to go up more. They're very high right now. I was talking to someone this morning that owns a big SUV. It costs almost $100 to fill up their vehicle. Even if you're driving a fuel-efficient car, it costs a lot of money. So I think they're going to continue to go up until the turmoil in the Middle East settles down.

Ms. Maurillo: Thank you, Mr. Secretary. And finally, Tupelo Middle School. Do *you* have a question for the secretary?

Q: (**Tupelo Middle School, Lee**) Do you know how high the prices are actually going to get?

A: (**Secretary LaHood**) Really, nobody knows. Some of it depends on what's happening in the world. Some of it depends on whether we have the refining capacity.

There are some people that are saying we should drill for our own oil. We do have a pretty good supply of oil in our own country, and some people think we should open up the Gulf of Mexco to more oil production. I was just with the Secretary of the Interior, Secretary Salazar, and he was pointing out to me that they are beginning to issue a permit for the Gulf of Mexico, which is good. But I don't think anybody knows how high gasoline prices are going to get.

It's too high now. It's hurting a lot of people who live on a very limited amount of money, and we know that many people in America are unemployed, too. For the people who are unemployed, it makes it even more difficult because they don't have a regular income to sustain the kind of life that they would like.

So it's a very dificult time for most Americans when it comes to energy costs, which include heating your home, or air-conditioning your home, or, certainly, for businesses, who have to pay utilities, or for those who drive automobiles.

Ms. Maurillo: Thank you, Mr. Secretary. Do you have any final words of wisdom for the students before we close the program?

Secetary LaHood: First of all, thank you again for participating in this program. Thank you for your interest in transporataion. Transportation and energy, as you can see, are tied together very, very closely. I want to encourage you to continue your interest in transportation.

We have a web site, dot.gov, where you can get a lot more information about what we do at the Department of Transportation. I encourage you to check it out, and if you have questions, I have a blog which is called “Fast Lane.” Sometime, if you have a question that you’d like to ask me, you can send it in there. I also have a Facebook account that you can check out. You can find all these things – our web site, my own blog, “Fast Lane,” and my Facebook account.

If you have questions after this, if you want to send me a question, we’ll answer it, and we’ll try and get back to you as quickly as we can. We want to give you a lot of encouragement to continue, for those of you who are interested in transportation. So thank you for coming to DOT. Thank you for participating from around the country, and good luck! (applause)

Ms. Maurillo: Thank you very much. I’d like to note that I visit the secretary’s blog frequently, and it has been noted that it is one of the most popular and one of the best blogs that the government has. So I would encourage you to visit it.

And good luck to everybody! We will notify you within the next week or so which team has won. Again, I want to thank the teachers especially, because I know this is an extracurricular activity for you. We do appreciate your generosity and your dedication to your students. Thank you very much! (applause)

APPENDIX A: ABOUT GARRETT MORGAN

GARETT 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.

Figure 1. Garrett Augustus Morgan as a Young Man

Despite his humble beginnings and lack of formal education, Mr. Morgan made a great impact on the transportation industry. But it was only after his death in 1963 that Mr. Morgan was awarded a citation by the U.S. government for his significant inventions.

Not only did he invent the zig-zag attachment for sewing machines, but he also invented the first successful gas mask and used it himself to rescue several men trapped in a tunnel. Many fire departments ordered the mask, but when they found out that the inventor was a black man, they canceled their orders. He had to hire a white man who pretended to be Garrett Morgan so people would buy the masks.

In 1923, Mr. Morgan invented and patented a successful traffic signal. It was during this time that automobiles were 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 at half-mast, 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 mission to provide technology transfer, education and research on current issues and emerging solutions in 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.

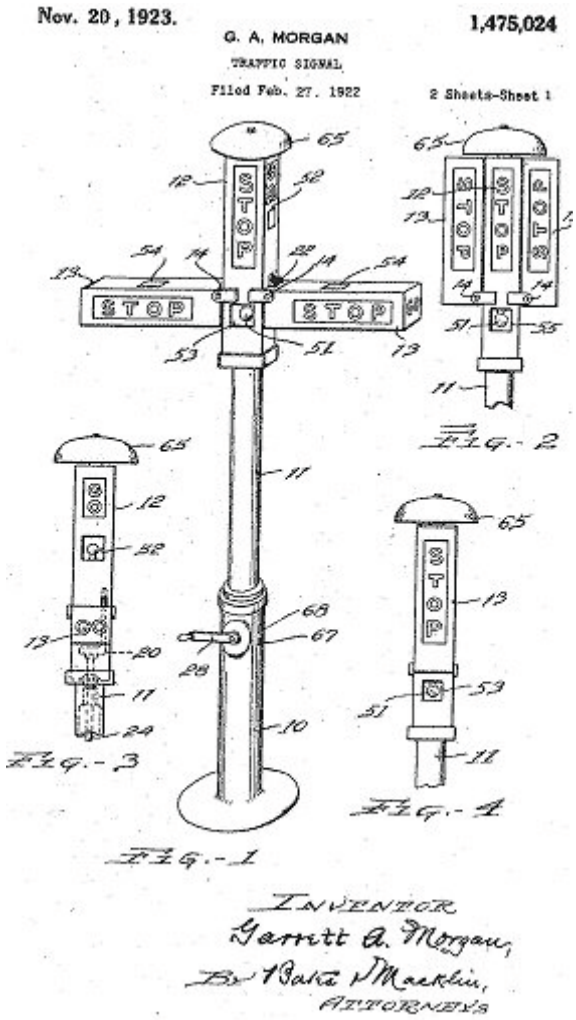

Figure 2. Garrett Morgan's Traffic Signal

Teachers and students address the topic of sustainable transportation and propose innovations for surface transportation. 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 transit, and innovations in transportation safety and security.

Through the work of many people, this event and this publication add to the spirit of transportation innovation and progress that Garrett Augustus Morgan personified so well.

MINETA TRANSPORTATION INSTITUTE

The Norman Y. Mineta International Institute for Surface Transportation Policy Studies was established by Congress in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The Institute's Board of Trustees revised the name to Mineta Transportation Institute (MTI) in 1996. 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.

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