WELCOME & INTRODUCTIONS

Phil Magney, Co-Chair
CEO and Founder, VSI Labs

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MEETING GOALS

1. Learn about new, innovative CAV technologies
2. Gain consensus on the council's vision, mission, goals & shared values
3. Build consensus on a statewide innovation alliance model
4. Goal is to finalize the annual report

CURRENT CAV PROJECTS IN MINNESOTA

MAYNARD FACTOR, KRATOS DEFENSE

2

MINNESOTA CAV CHALLENGE

GEORGE CRONIN ★ awards for ★ Procurement Excellence ™

DESTINATION CAV
THE FUTURE OF MOBILITY IS IN MINNESOTA

POLARIS INDUSTRIES INC.
wsb
DEPARTMENT OF PUBLIC SAFETY STATE OF MINNESOTA
AECOM
iteris
VISION SYSTEMS INTELLIGENCE
EY
TRAFFIC CONTROL CORPORATION
plus.ai
id8 INNOVATE DESIGN CREATE
HDR
creative enterprise zone
HNTB
applied INFORMATION
KRATOS DEFENSE & SECURITY SOLUTIONS
First Transit
here
Athey Creek CONSULTANTS
WSP
THE EHRLICHMAN GROUP
EASY MILE
Center for Transportation Studies
ALLIANT
MobilityMania Accessibility for All
3M

53 VENDOR MEETINGS

28 PROPOSALS SUBMITTED

12 AWARDED PROJECTS

DESTINATION CAV

DEPARTMENT OF TRANSPORTATION

Autonomous Truck Mounted Attenuator (ATMA)

THE ATMA
THE AUTONOMOUS TMA TRUCK

Royal
TRUCK & EQUIPMENT INC.

00:03.38

DEPARTMENT OF
TRANSPORTATION

NASDAQ: KTOS

What is a TMA

A Truck Mounted Attenuator (TMA) is a **human-driven mobile crash barrier** that follows behind a highway maintenance vehicle, shielding workers and equipment ahead from errant drivers entering the work zone.

TMA's are

- Operated in all 50 states
- Thousands are deployed daily / nightly
- Support operations that include:
  - Line Painting, Sweeping, Weed Spraying

NASDAQ: KTOS

Why Automate

Driving a TMA is recognized as one of the **most dangerous assignments in the work zone**.

- Across the US there are over **70 crash-related injuries** and **12 fatalities** every week in the work zone (ref: Federal Highway Administration)

- TMA drivers are at significant risk of lifelong injury, painful rehabilitation, and even death

- Impact vehicles can be 80,000 lb. tractor-trailers traveling at 65+ mph

THE ATMA REMOVES THE DRIVER FROM A "HIGH RISK" SITUATION

TMA

Ambulances

Impact Vehicle
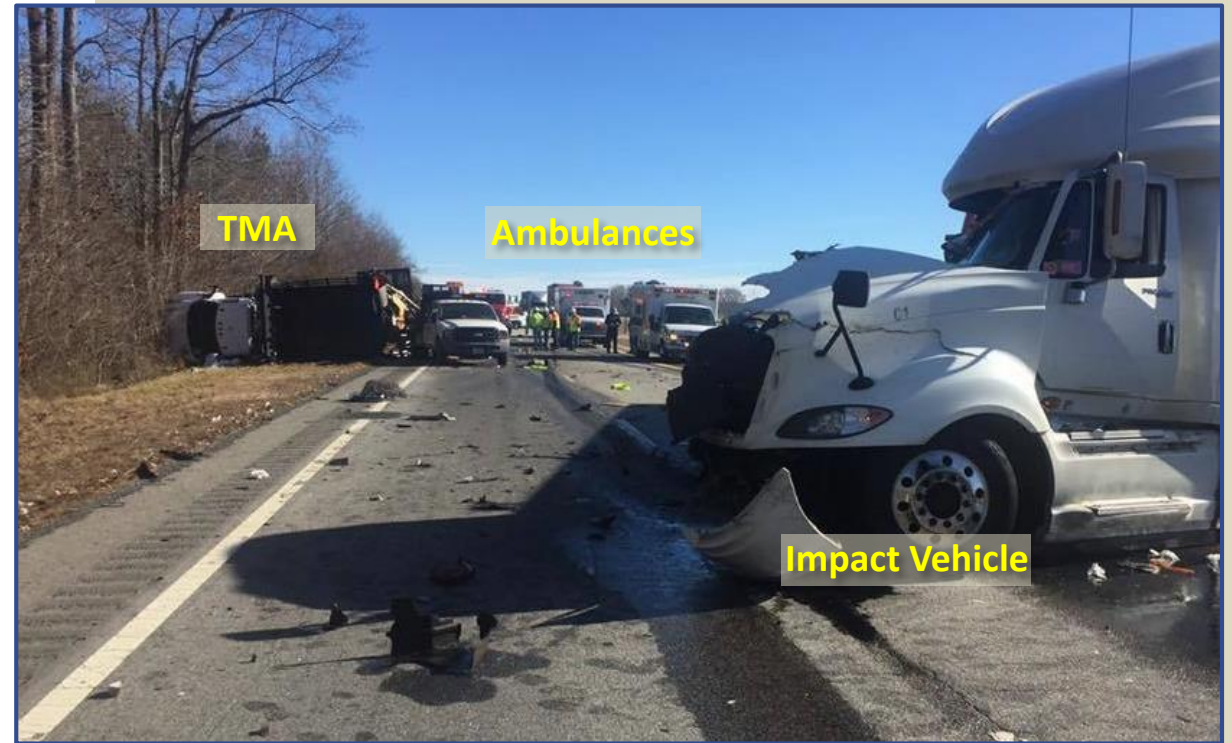
*Tractor-trailer impact of a Virginia Department of Transportation (VDOT) TMA

Crash Statistics

KRATOS has made a push for the ATMA innovation as a result of a number of brutal national statistics.

Work Zones 2015*

In the U.S.
*Federal Highway Administration

Crash Every 5.4 minutes

70 Crash-related Injuries Daily

12 Crash-related Fatalities Weekly

In the U.K.
*Highways England

741 Crash-related Fatalities Yearly

A game changing **solution** for improving **saftey** and **efficiency** in the work zone.

*crash highlights value of ATMA

- **32,719** - # of motor vehicle fatalities from 2012-2013
  *Fars Annual Report
- **92,626** - # of crashes in work zones in 2015
  *US DOT FHA Facts & Statistics

- **41%** - of crashes were rear-end collisions in work zones
  *"Identification of Work Zone Crash Characteristics"
- **90%** - of traffic crashes in Florida are due to human error
  *2015 FL Department of Transportation

TMA Driver Testimony

An actual TMA Truck survivor providing testimony about the benefits of the Autonomous TMA

"This is going to save lives. This is going to prevent any of us to have to come back here and talk about how we almost died and how we could have not seen our kids"

Legislation passed the Senate and House unanimously and is now law in PA (ACT 117)

NASDAQ:
KTOS

The Technology

The Autonomous Truck Mounted Attenuator (ATMA) is a CAV solution that **removes the human** from the **most dangerous assignment in mobile highway operations**.

Key Features

- **Manned or Unmanned** – system easily switches from a manned operation to an unmanned operations
- **System Redundancy** – reduces possibility of single point failures
- **Cybersecurity Precautions** – prevents malicious hacking
- **Advanced Active Safety System** – automated E-Stop capabilities
- **Enhanced Obstacle Detection** – front and side view protections
- **User Controls** – user adjustable gap and lateral alignment
- **GPS-denied Navigation** – status-at-a-glance and operator controls

Navigation data transmitted from a Manned Leader Vehicle enables the ATMA to follow behind **completely unmanned** in a "Leader/Follower" configuration.

Steering Actuators

A **retrofit kit** solution enables any fleet vehicle to be converted into an autonomous system. System components include on-board computer, navigation system, actuators, user interface, and active safety system.
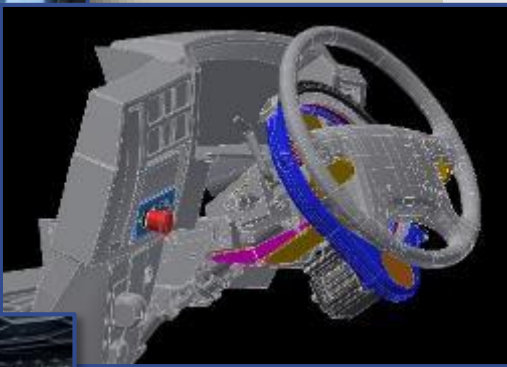
Obstacle Detection & Avoidance

Leader Vehicle User Interface

E-Stop Safety

ATMA in Action

TDOT PAVING THE WAY TO THE FUTURE
TESTING AUTONOMOUS ATTENUATORS

00:31.33

ATMA in Action

Deployments

There is significant worldwide interest in the deployment of the ATMA which uses currently available **driverless technology** to solve a real-world problem.

Deployments

- **More than 2,000 miles of operation since 2017**
- Deployed 6 systems to date in locations that include
  - England, CO, MO, CA, MN, and TN
- Pooled Fund – hosted by CDOT serves an ATMA discussion forum for topics such as:
  - system improvements
  - expansion of use
  - refining policy and operational procedures
  - Investigation of additional applications of technology
  - 13 participating states to include:
    - AL, CA, CO, IL, KS, MN, MO, NV, OH, OK, TX, VA, WA

England - COLAS

Missouri DOT

Colorado DOT

Caltrans

Minnesota DOT

Tennessee DOT (Leased)

Testimonials

"JUST IN THE LAST FOUR YEARS, THERE HAVE BEEN 26 INCIDENTS WHERE A MEMBER OF THE TRAVELING PUBLIC STRUCK A CDOT IMPACT PROTECTION VEHICLE - THAT'S ALMOST SEVEN PER YEAR," SAID SHAILEN BHATT, CDOT EXECUTIVE DIRECTOR. "THIS IS A DANGEROUSLY HIGH NUMBER WHEN YOU CONSIDER THAT IN SOME INSTANCES, A CDOT EMPLOYEE IS SITTING IN THE DRIVER'S SEAT OF THE VEHICLE THAT WAS HIT. BY USING SELF-DRIVING TECHNOLOGY, WE'RE ABLE TO TAKE THE DRIVER OUT OF HARM'S WAY WHILE STILL EFFECTIVELY SHIELDING ROADSIDE WORKERS. THE SUCCESSFUL DEMONSTRATION OF THE AIPV PROVES THAT TECHNOLOGY CAN TAKE TRANSPORTATION SAFETY TO A NEW LEVEL AND FOREVER IMPROVE THE WAY WE WORK," BHATT SAID.

"We welcome this innovative work by COLAS which, through the use of connected and autonomous vehicle technology, has the potential to help the sector address the risks road workers face on a daily basis."

Mike Wilson, Executive Director for Safety, Engineering, and Standard at Highways England

Benefits

The ATMA aligns with Federal Highways **work zone safety** objectives and is a great implementation of CAV technologies to improve the day-to-day lives of our workers.

Work Zone Safety

Reduced Worker Exposure to Danger

- **Increased Safety** – keep your workers out of harm's way – now protected by the ATMA
- **Improved Worker Quality of Life** – reduced work zone anxiety
- **Lower Costs** – fewer injuries means fewer liability claims
- **Work Zone Optimization** – increased efficiency means less time on the road

Ideal for CAV Program

Easy to Use, Easy to Deploy

- **Clearly Defined Objective** – Safety
- **Operates in Specific Environment** – mobile highway maintenance operations
- **Operates at Slow Speed** – typical <15 mph
- **Requires 0 Mods to Existing Infrastructure** – deployable any time/where
- **Positive Public Awareness** – a feel-good story that everyone can understand

Better Employee Experience

Enhanced With Technology

- **Safety** – TMA vehicles are now operated from a safe location; the lead vehicle
- **Advancing Skill Set** – an opportunity to work with CAV technologies
- **Availability** – able to support other work zone activities – cross training

Why Minnesota

The strategic vision, technology adoption, public collaboration, and skilled work force make the State of Minnesota an **ideal** location for an ATMA deployment.

Vision
Minnesota has the vision to recognize that CAV technologies will transform the future of transportation and safety

Technology Focused
Minnesota is enabling CAV deployments with high tech upgrades facilitating V2V communications, lane-following navigation, and real-world operational testing

Collaboration
Minnesota has created the CAV-X office with a strategic plan that facilitates collaboration among experts from the State, businesses, partners, and the public

Work Force
Minnesota is a global center for innovation with the highly educated and entrepreneurial work force needed to facilitate successful CAV deployments

DEPARTMENT OF TRANSPORTATION

REVIEW COUNCIL'S VISION, MISSION & GOALS

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VISION, MISSION, VALUES & GOALS

Vision	Mission	Goals	Shared Values
Shows where you want to be in the future (where we are headed)	Who we are and how we achieve our vision (why the Council exists)	Similar to shared values. What must be accomplished to implement mission & vision	Principles the Council subscribes to (what we stand for)

COUNCIL'S VISION

Building a future of transportation that is
safe, equitable, accessible, efficient, healthy, and sustainable.

COUNCIL'S MISSION

The Governor's Council on Connected and Automated Vehicles collaborates with stakeholders, partner with private industry, and engages communities to prepare Minnesota for a future with emerging transportation technologies

GOALS

CAV ADVISORY COUNCIL

- **Safely** test and deploy connected and automated vehicles (CAV)
- Promote **access** to transportation for all users
- Develop an innovation **workforce**
- Design a clear **regulatory** environment
- Work with other levels of **government**
- Promote **healthy, sustainable communities** through transportation technology
- Invest in a system that **inclusively** meets the needs of **all multi-modal users**.

DESTINATIONCAV

DEPARTMENT OF TRANSPORTATION

SHARED VALUES

CAV ADVISORY COUNCIL

Equity: Advance policies that promote transportation equity

Mobility and accessibility: Promote inclusive policies that meet the needs of all users

Trust: Uphold the public's interest with clarity and transparency. Understand community concerns about CAV technology and incorporate feedback into policy

Public Health and Environment: Promote active transportation – like walking and biking – and healthy communities. Advance technology and policy that minimize environmental impacts

Multi-Modal Efficiency: Support transit, freight and other modes. Guard against increased congestion

Readiness: Prepare our workforce and businesses for the changes that technology will bring. Test and pilot technologies to ensure they meet the needs of all Minnesotans.

3-YEAR PRIORITIES

CAV ADVISORY COUNCIL

1. Equity, mobility, accessibility, public health and environment
2. Industry and research partnerships
3. Infrastructure investment
4. Law for safe testing and deployment
5. Education, outreach, engagement and demonstrations
6. Economic and workforce development
7. Data privacy and cyber security
8. Insurance and liability
9. Alignment with other states/federal government
10. Human factors research of CAV impacts on users

DEPARTMENT OF TRANSPORTATION

MENTIMETER EXERCISE

GO TO MENTI.COM

ENTER 50 73 3

DISCUSSION

BREAK

STRUCTURING AN ALLIANCE

4

INNOVATION ALLIANCE

MINNESOTA INNOVATION ALLIANCE

- Network of local, regional, and state organizations committed to a safe, equitable, accessible, efficient, healthy, and sustainable transportation system for all.

- Broad partnership that includes universities and technical colleges, industry, and government to coordinate statewide CAV activities
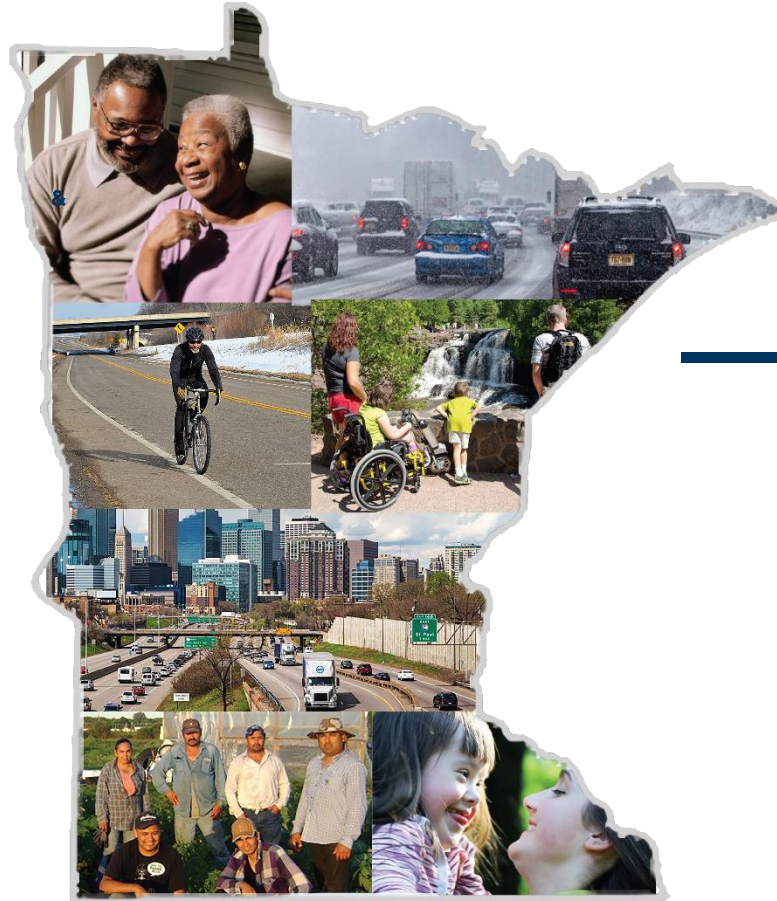
DESTINATION CAV

DEPARTMENT OF TRANSPORTATION

MEMBERS

COLLABORATION WILL HELP US SOLVE THE CHALLENGES THAT COME WITH TRANSPORTATION

BUSINESS
INDUSTRY
ENGINEERING
TECHNOLOGY
MEDICAL

CITIES
COUNTIES
MPOS

UNIVERSITIES
COLLEGES
VOCATIONAL
K-12

FREIGHT
TRANSIT
EQUITY
ACCESSIBILITY
MOBILITY

DESTINATIONCAV

DEPARTMENT OF
TRANSPORTATION

POTENTIAL SUBCOMMITTEES

FOCUS AREA	PRIORITIES	
SAFETY & LAW ENFORCEMENT	• Public safety • Law enforcement	• Emergency services • Crash reporting
CONNECTIVITY & DATA	• Data privacy • Data sharing	• IT & architecture • Data governance
INFRASTRUCTURE INVESTMENT	• Curb space mapping • Signals	• Pavement markings • Signs • Fiber optic
LABOR & WORKFORCE DEVELOPMENT	• Operators, mechanics & dealers • Workforce development	• Educational partnerships • K-12 pipeline
OUTREACH & EDUCATION	• Public demonstrations • Workshops & conferences • Open houses	• Websites • Surveys

DESTINATION CAV

DEPARTMENT OF TRANSPORTATION

BREAK OUT

- (1) WHAT ARE ALLIANCE MEMBERS' ROLES AND RESPONSIBILITIES?

- (2) WHO SHOULD BE INVOLVED?

- (3) WHAT SHOULD THE SUBCOMMITTEES PRIORITIES FOCUS ON?

REPORT OUT

CAV ANNUAL REPORT

FINALIZE THE REPORT TO THE GOVERNOR

5

GENERAL COMMENTS & CONSENSUS

FUTURE MEETINGS

6

3-YEAR PRIORITIES

CAV ADVISORY COUNCIL

1. Equity, mobility, accessibility, public health and environment
2. Industry and research partnerships
3. Infrastructure investment
4. Law for safe testing and deployment
5. Education, outreach, engagement and demonstrations
6. Economic and workforce development
7. Data privacy and cyber security
8. Insurance and liability
9. Alignment with other states/federal government
10. Human factors research of CAV impacts on users

DEPARTMENT OF TRANSPORTATION

1-YEAR PRIORITIES

CAV ADVISORY COUNCIL

1. Industry and research partnerships

2. Education, outreach, engagement and demonstrations/pilots

3. Equity, mobility, accessibility, public health and environment

DESTINATION CAV

DEPARTMENT OF TRANSPORTATION

MENTIMETER EXERCISE

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PUBLIC COMMENT

7

CLOSING

8

UPCOMING EVENTS

MARCH 3-4 - MINNESOTA TRANSPORTATION CONFERENCE, ST. PAUL

APRIL: AUTOMATED VEHICLE DEMONSTRATIONS, ST. PAUL & ST. CLOUD (DATES TBD)

TUESDAY, MAY 26TH – 9:00 AM – 12:00 PM, ROCHESTER, MN