

Mobility, Transportation and Infrastructure

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UNITED STATES
DEPARTMENT OF TRANSPORTATION



Chris Atkinson

Director of Smart Mobility & Professor of Mechanical...
2w · Edited · 🌐

Very pleased and excited to receive my new Ford Mustang Mach E GT this week. And especially proud that my son, [Brett Atkinson](#), had a hand in its production launch in Mexico last year - although that was cut short in March 2020 due to the pandemic. The car is super quick, comfortable and energetic - a great driver's car. Well done, Ford! [#ev](#)



👍❤️ 1,489

90 comments · 105,615 views



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Most relevant ↻



Jim Farley · 2nd

Chief Executive Officer at Ford Motor Company
4d

Nice car! Glad you are enjoying it.

Like · 🌐🌐 88 | Reply · 7 replies

**31 years, 16 vehicles:
11 gasoline, 1 diesel, 1 FFV,
1 HEV, 1 PHEV, 1 EV.**

Transportation is the movement of people and goods through a multiplicity of modes.



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Mobility is or should be “transportation with a conscience”.

Infrastructure is the physical and digital foundation or underpinning of transportation and mobility.

Mobility is of paramount importance for our economic and physical well-being, and for the progress of society.

Transportation is the means – mobility is the end – and infrastructure is the foundation.

- **Electrification & Decarbonization**
- **Connectivity**
 - V2X, 6G
- **Computing**
 - Distributed & Ubiquitous
 - Edge & Cloud
- **Data Analytics and IoE**
- **AI, ML and DL**
- **Automation & Robotics**

Enabling Technologies



Human Interactions



- Human-Machine Interface
- Human-Machine Interaction
- Automation
- Human Factors

Emerging Applications



- **Smart Mobility**

Transportation and Infrastructure

Current Societal Pressures



- Disruptions
- Digitization
 - The Future of Work
 - Social Engagement
 - The New Economy

Beneficial Societal Outcomes



- Economic Development and Community Development
- A more just and equitable society

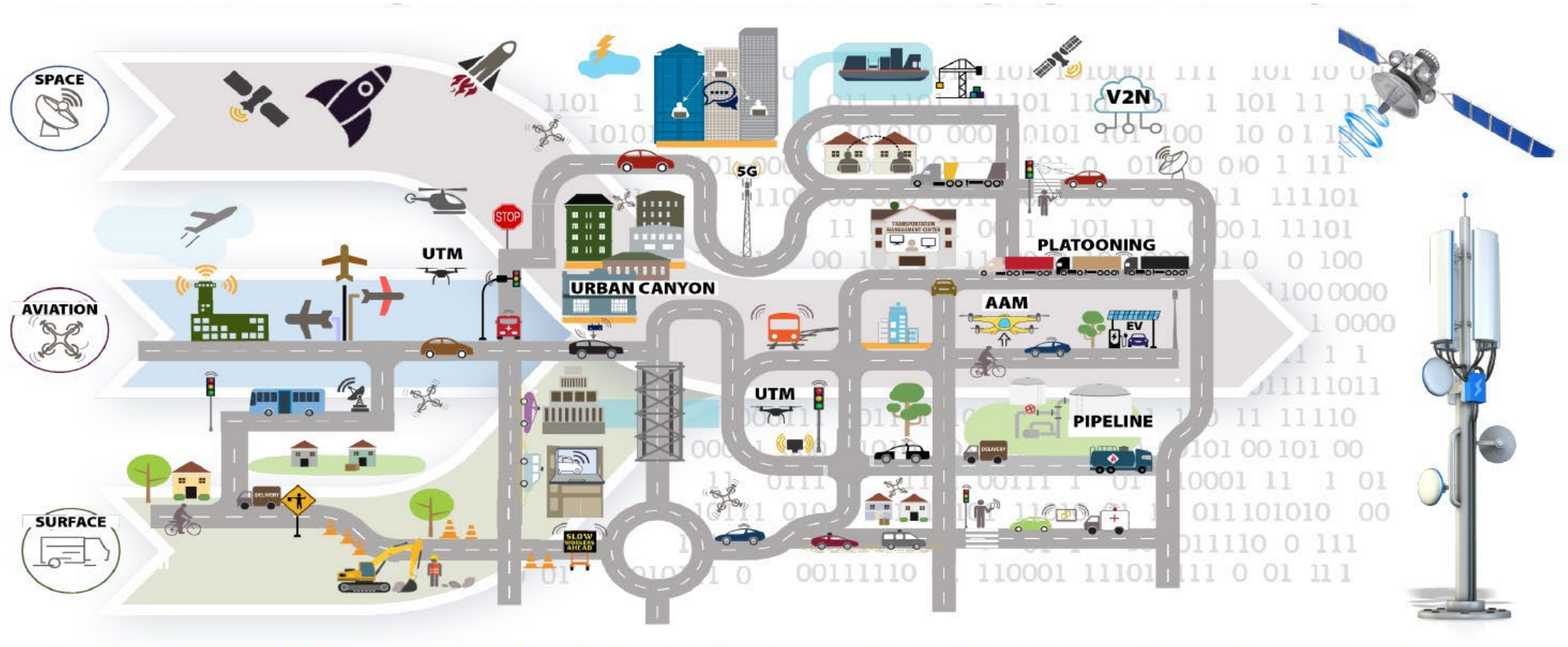
Mobility

Social and Environmental Conscience



- **SAFETY**
- Environment
- Energy
- Sustainability
- Social & Ethical
- Equity and Access
- Human and Public Health
- Legal, Policy and Regulation

Mobility, Transportation and Infrastructure

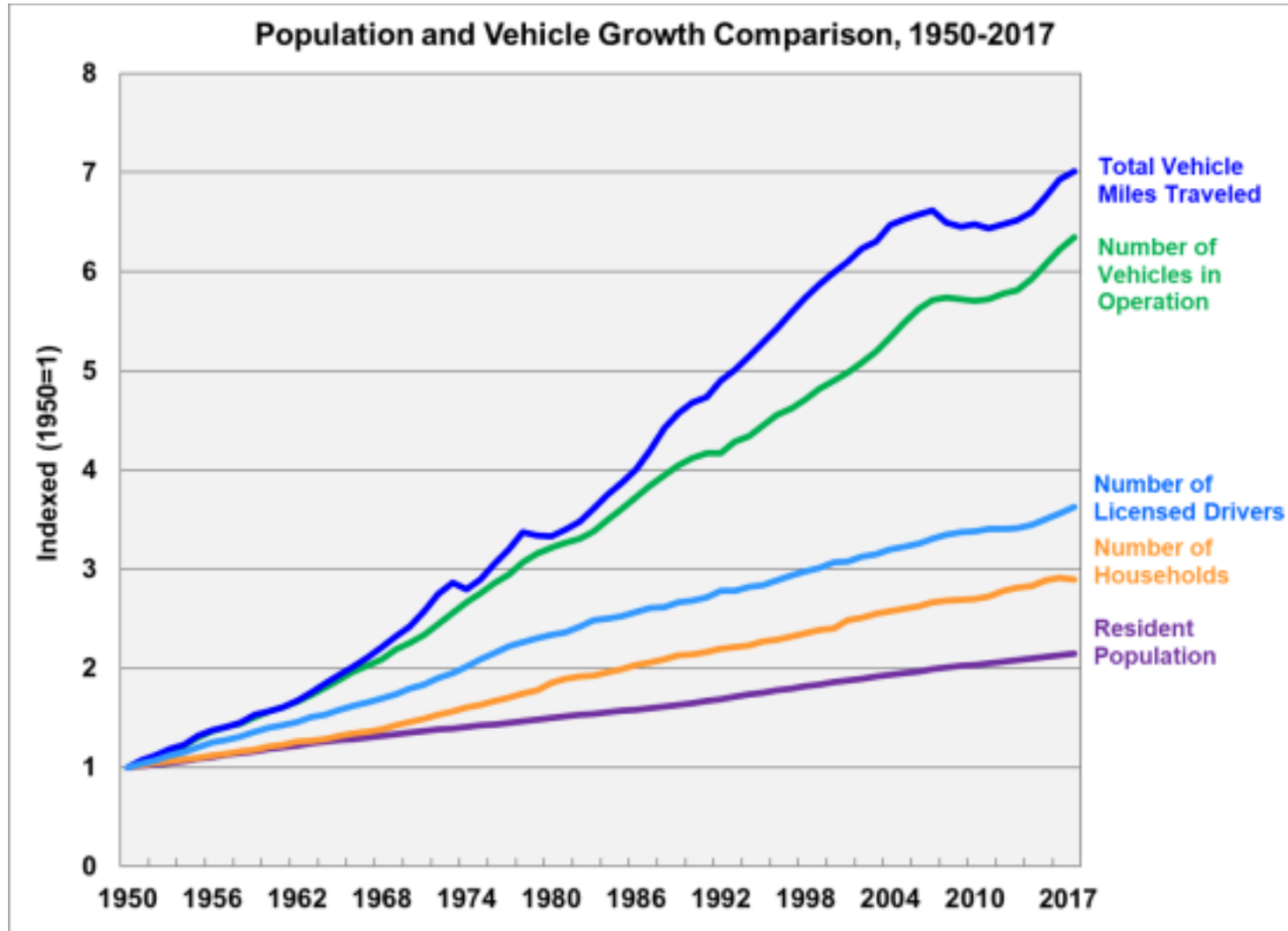


US GDP and VMT - Historical

**US GDP
2021
\$21.5T**

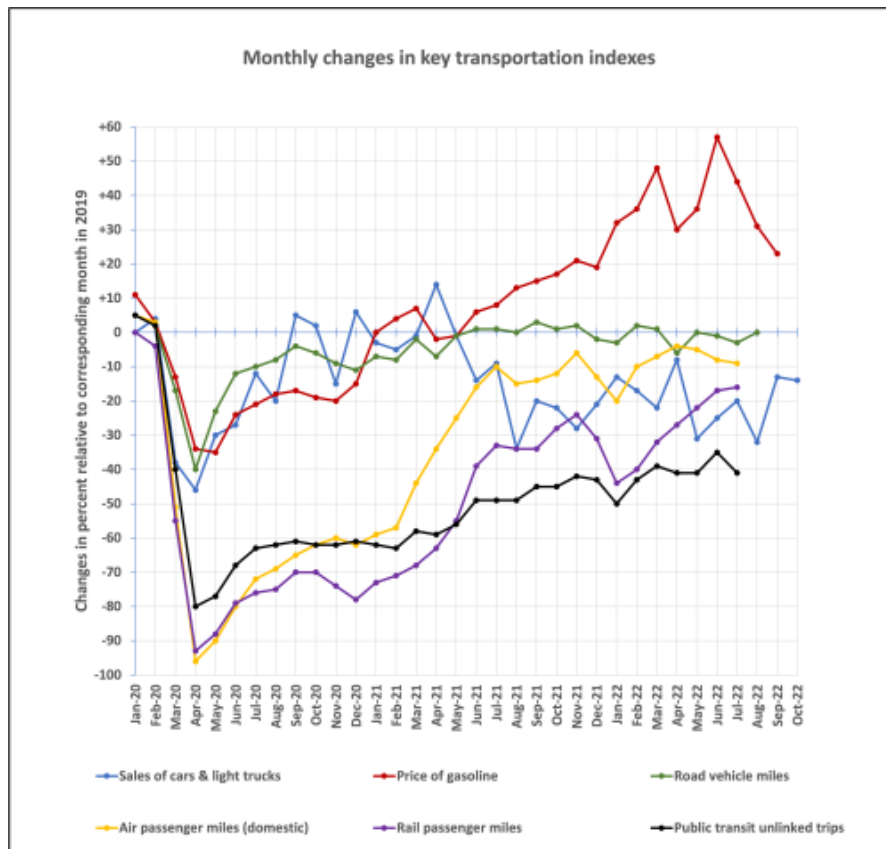
**US VMT
2021
3.2T**

**GDP/VMT
\$6.72/mile**



Reversion to the primacy of the individually owned, individually operated LD vehicle.

Michael Sivak (2022)



Light Duty Vehicles

- 13.1M new vehicle sales (2022) vs. 17.1M (2019)
- ~9M new car sales lost since 2019
- Rediscovered the complexity of the supply chain
- Ave. sales price \$47.5k, or \$65k for EVs
- ~8% BEV+PHEV sales (Sept. 2022)
- Ave. vehicle ~12 years old (2022)
- Ave. US household income \$61k/yr (2021)
- SAFETY!



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Advanced Research Project Agency – Infrastructure (ARPA-I)

Overview of ARPA-I

- The Infrastructure Investment and Jobs Act (IIJA) of 2021, known as the Bipartisan Infrastructure Law (BIL), authorized the establishment of the **Advanced Research Projects Agency - Infrastructure (ARPA-I)**, a new agency housed within OST-R.
- “Infrastructure” refers to “any transportation method or facility that facilitates the transit of goods or people within the United States.”
- ARPA-I will invest in innovative technology projects that industry is unlikely to undertake due to technical and financial uncertainty.
- ARPA-I will collaborate with technology innovators from the public, private, and academic sectors – including with minority-serving institutions – to develop transformative solutions for infrastructure and transportation systems.



ARPA-I's Mission

(Draft):

ARPA-I's mission is to catalyze the development of innovative technologies, systems, and capabilities that transform the nation's physical and digital infrastructure to ensure American leadership. We aim to build the future of transportation that is safe, secure, efficient and resilient, while achieving net-zero emissions and increasing equity and access for all.



ARPA-I's Mission

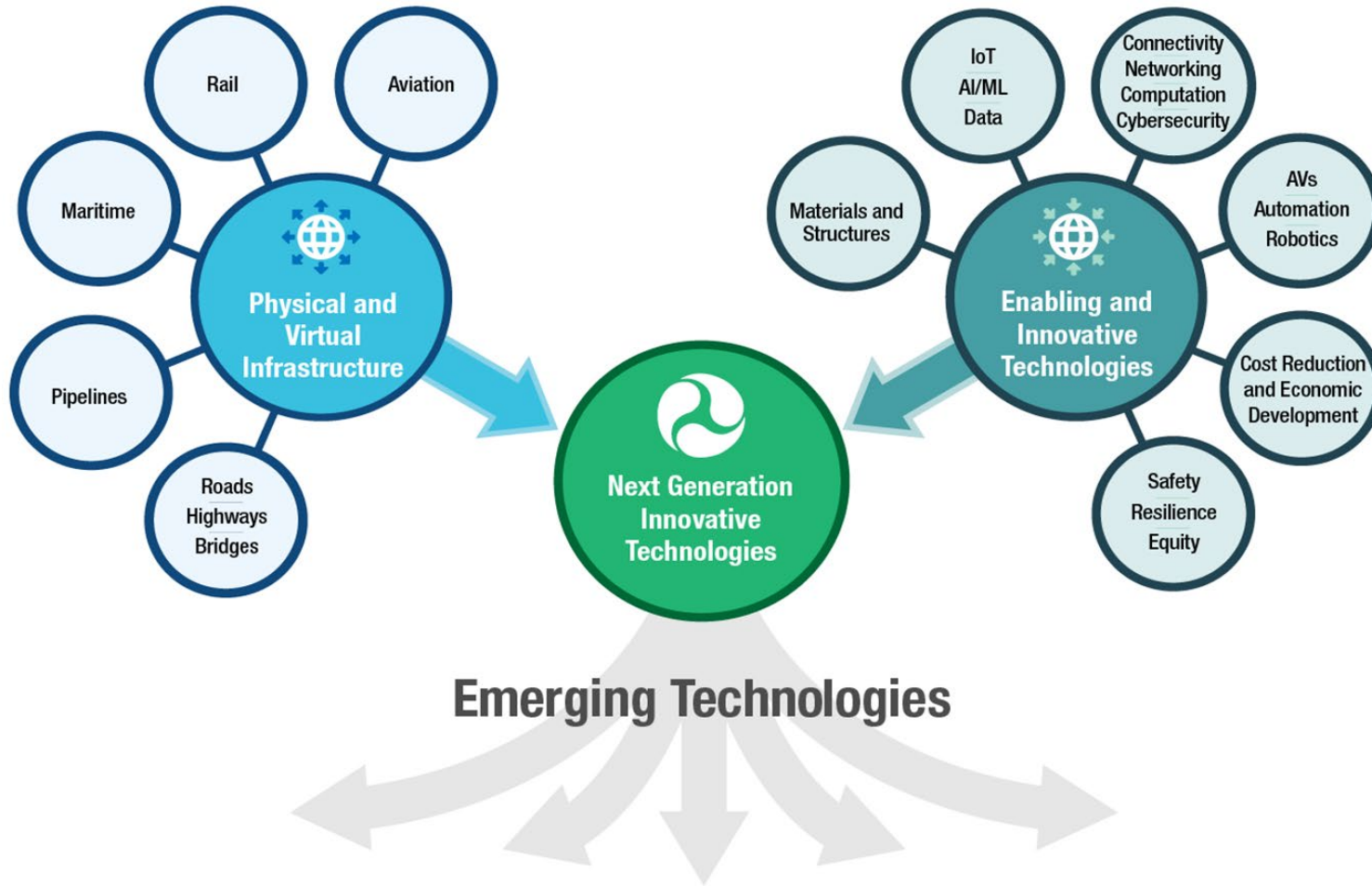
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The Goal of ARPA-I

Develop Innovative Infrastructure Technologies and Solutions for Transportation



- ARPA-I will be to Transportation as DARPA is to Defense, and ARPA-E is to Energy
- Develop innovative solutions to persistent problems in infrastructure and transportation
- Unleash US innovation and creating new infrastructure R&D ecosystems
- Ensure the US has a 21st Century Infrastructure System and will reach the goal of net-zero GHG emissions by 2050
- Develop infrastructure that will create the safest, most efficient, climate friendly and resilient transportation system in the world



Topics of Interest for ARPA-I

Advancing DOT priority goals: Transformation, Safety, Climate, and Equity

Materials, Structures, and Construction

- Zero or negative carbon materials for infrastructure, extremely durable and resilient concrete, accelerated construction processes (3D printing of pavement, bridges, tunnels, water infrastructure, and high-speed rail beds), accelerated construction of seawalls and shoreline reinforcement

Digital Infrastructure for Mobility

- 6G and edge computing for automated vehicles (AVs), intrinsically assured AI and ML for AVs, virtual LIDAR and ubiquitous machine vision, digital twins, HD mapping of infrastructure and topology

Automated Surface, Air, and Maritime Vehicles

- AV development, testing and validation, vehicle connectivity and networking (V2X), freight and logistics automation, fully electrified transportation – in-situ charging, V2G
- AI-enhanced ATC and ATM, assuring safety for autonomous aircraft, infrastructure modifications for AAM integration; Autonomous shipping

Cross-cutting and Enabling Technologies

- Advanced PNT – millimetric accuracy (including signals of opportunity), cybersecurity (once and for all) – intrinsically secure networking and data transmission for mobility infrastructure, digital twins of transportation systems and infrastructure, AR and VR for travel replacement



ARPA-I Opportunities

Sample Opportunities:

- Intersection Safety Challenge to reduce fatalities at intersections (over 10,000 fatalities per year in the U.S.) using machine perception, artificial intelligence and machine learning, real-time decision-making, and active warning systems
- Develop new pavement materials that self-heal, absorb carbon, allow for water drainage, and reduce heat island effect, addressing maintenance issues as well as climate adaptation and mitigation
- Build and future-proof the supply chain and transportation logistics sectors using common data systems, and integrating shipping, rail, and trucking
- Many other opportunities, including approaches to reduce congestion, asset maintenance and operations, and increased transportation resilience and system efficiency

→ **Advancing DOT priority goals: Transformation, Safety, Climate, and Equity**



The ARPA Model

The ARPA model uses unique governance and execution to succeed

ARPA mission:
Create breakthrough, paradigm-shifting capabilities for a critical public purpose

which requires

A high-performing agency that achieves seemingly impossible goals

which requires

Taking risks, managing them effectively, experimenting, learning, adapting quickly,
tapping into many different talents and institutional capacities

which requires

Governance that holds the agency
accountable for delivering on its mission
and creates space for it to do so

&

Execution with people, processes,
and culture that are mission-
obsessed, fast, and flexible



Why ARPA-I

ARPA-I will fill a Key Gap* in Transportation and Infrastructure

- The Transportation and Infrastructure sectors are being left behind as other industries transform through *Fourth Industrial Revolution* technologies (AI, Robotics, IoT, Advanced Manufacturing and Materials)
- Transportation and Infrastructure suffer from fragmentation, limited competition, and sluggish commercial markets
- American's global competitiveness and security are at risk due to lagging and vulnerable infrastructure
- Overcoming these dynamics requires a mechanism to dramatically accelerate the research-to-deployment process
- ARPA-I offers the solution that supports advanced research, fosters internal and external partnerships, and facilitates commercialization to enable transformation in these sectors
- **ARPA-I will lift DOT's existing R&D capabilities and position DOT as a premier research-led organization**

*Note: ARPA-I was authorized in the Bipartisan Infrastructure Law (2021) but has not yet received appropriations



DOT Innovation in Intersection Safety

- Why innovation in safety is needed
- What is the new R&D innovation effort
- How you can help and collaborate with DOT

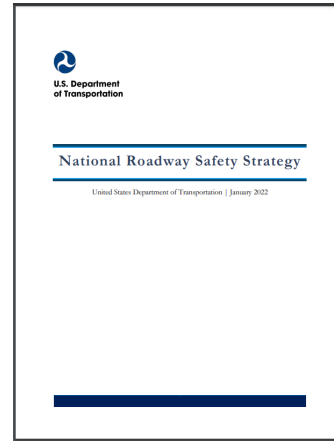
Motivation for Enhancing Intersection Safety

42,915 Road Fatalities in 2021
Highest in 16 Years
“A crisis...we must address”

(Secretary Pete Buttigieg, NHTSA report May 17, 2022)



- In 2020, **27%** of the total road traffic deaths involving an intersection
- That is **10,626** fatalities, including **1,674** pedestrians and **355** bicyclists



National Roadway Safety Strategy

- Adopts a Safe System Approach
- Supports implementation of the Complete Streets policies which prioritize safety and connectivity



SAFETY



TRANSFORMATION

USDOT Strategic Priorities

Safety: Make our transportation system safer for all people. Advance a future without transportation-related serious injuries and fatalities.

Transformation: Design for the future. Invest in purpose-driven research and innovation to meet the challenges of the present and modernize a transportation system of the future that serves everyone today, and in the decades to come.

Enhancing Safety at Intersections

Advanced Driver Assistance Systems (ADAS) technology shows significant improvements in vehicle safety – radar and camera systems that facilitate automated braking, adaptive cruise control, and lane keeping technologies.

Technologies in Automated Vehicles (AVs) utilize highly sophisticated machine vision and sensing modalities, data fusion, decision making, mapping, localization, and path planning techniques, along with AI to perform automated driving operations.

Equipping intersections with these technologies combined with visual and audible warning systems, can create significant near-term safety opportunities, prioritizing the most dangerous intersections that are often located in disadvantaged communities.

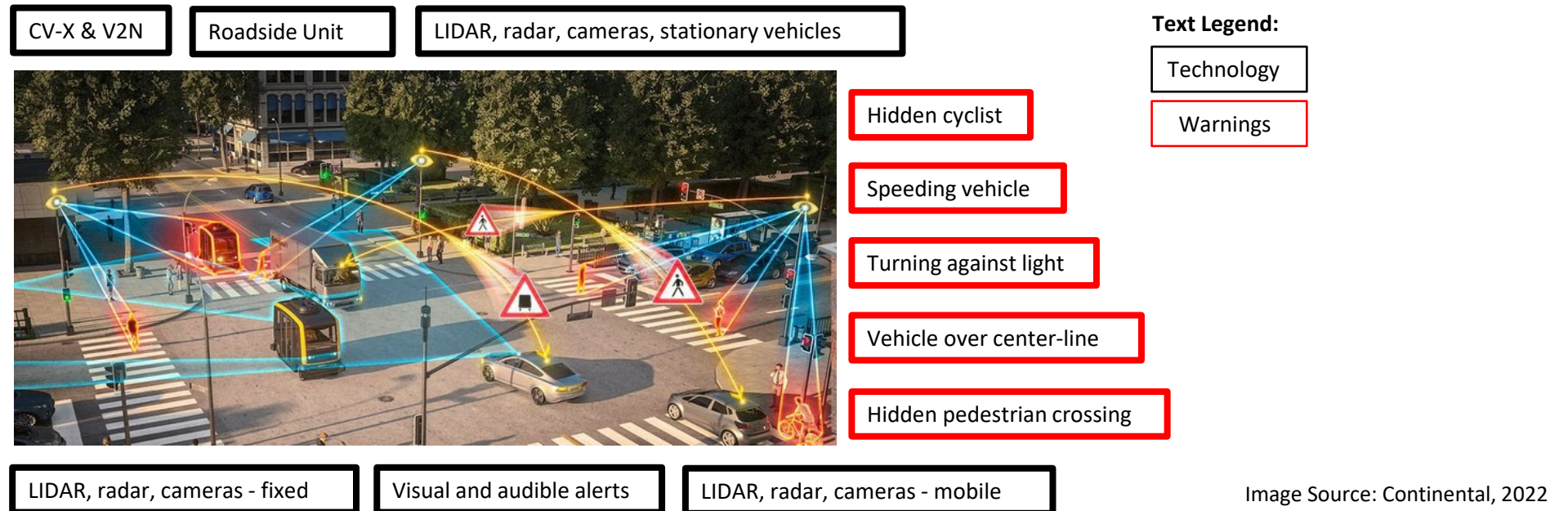
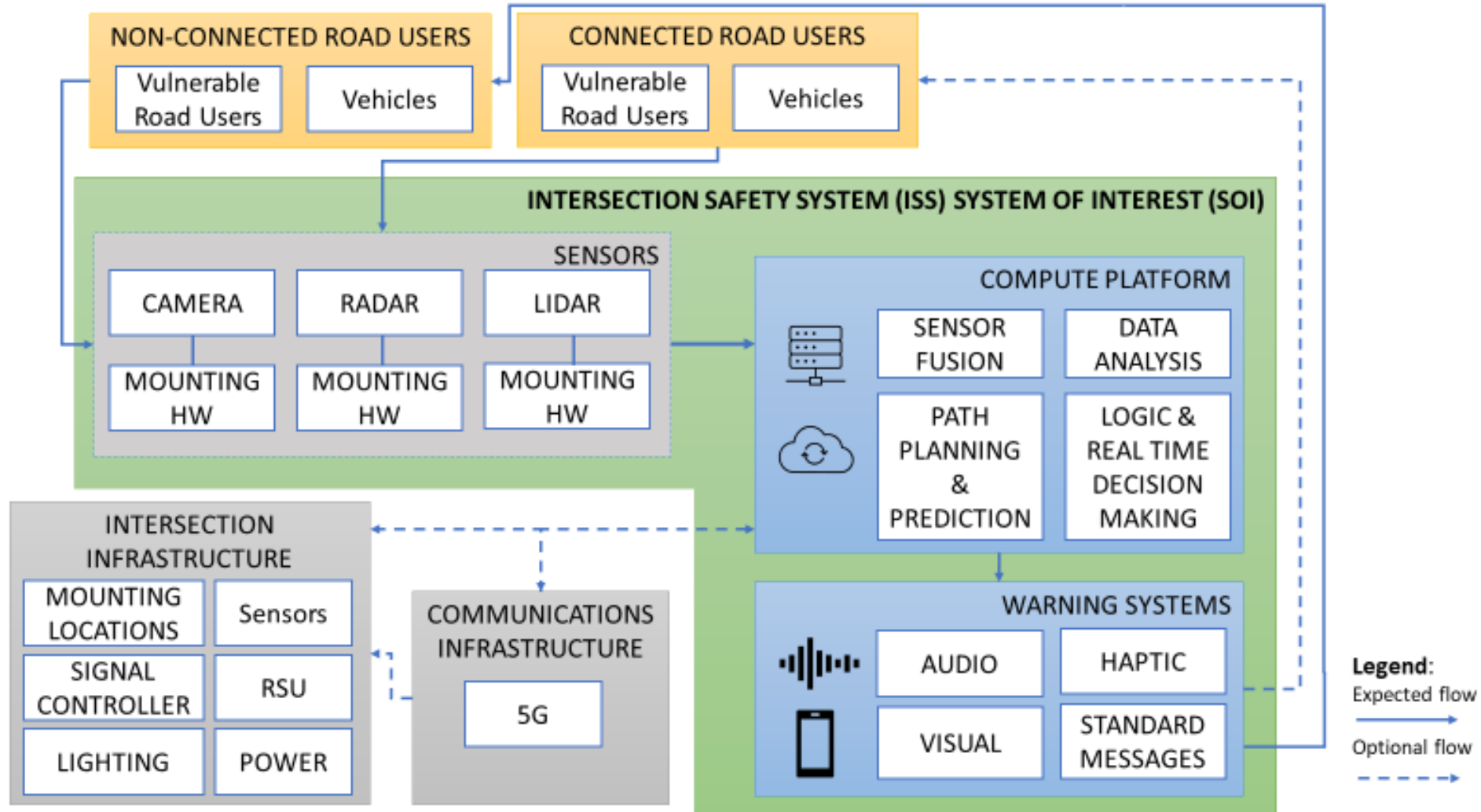


Image Source: Continental, 2022

A Conceptual Intersection Safety System



DOT Request for Information (RFI)

- RFI on “Enhancing the safety of vulnerable road users (VRUs) at intersections”
- Comment period in the Federal Register ends on November 16, 2022.



- DOT is interested in receiving comments on the possibility of adapting existing and emerging automation technologies to accelerate the development of real-time roadway intersection safety and warning systems for both drivers and VRUs in a cost-effective manner that will facilitate deployment at scale.
- **Submit ideas to DOT online!**
- <https://www.federalregister.gov/documents/2022/09/16/2022-20188/enhancing-the-safety-of-vulnerable-road-users-at-intersections-request-for-information>

Ideas from the best, brightest, and most creative minds like you will help us realize the vision of improved intersection safety!

Safety First.

Thank You!

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