

The Future of Transportation

Transforming Transportation System

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"If I have seen further, it is by standing on the shoulder of giants."  
Isaac Newton

"Knowing is not enough, we must apply."  
Leonardo da Vinci

If we were to stand on the shoulders of these giants, could we imagine today's forms of transportation?

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Convergence of Exponential Techs

Add localization and connectivity to the mix...

Combine IBM + WWW + GPS + ...

and you can THEN access/navigate the world from/with your car

opportunities to shape what comes next

Now This is MORE FASCINATING!

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USDOT Strategic Goals

ORGANIZATIONAL EXCELLENCE

SAFETY

ECONOMIC STRENGTH AND GLOBAL COMPETITIVENESS

EQUITY

CLIMATE AND SUSTAINABILITY

will focus on TRANSFORMATION

STRATEGIC GOALS

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Transformation

We have experienced transformation many times in the past

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The Journey From Interesting to Fascinating We're Traveling Now

1888: Invention of AC induction motor

1891: First electric vehicle in the US

1954: Commercialization of silicon photovoltaics

1973: Oil Embargo

1988: Commercialization of Lithium Ion batteries

1991: UN establishes IPCC

1997: First mass-produced hybrid

2014: EV company becomes most valuable auto company in world

Cost of renewable energy less than generating coal power

What's Next

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Transformation/Change Is Not Easy

Several Challenges - One Good Change

Let's assume that a Transit Authority had set a Goal of 0 Emissions by 2050

Who Pays? How Charged? Service Hours Routing Workforce

Shifting to Electric Buses

There would be several challenges to be addressed

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Convergence of Exponential Tech – In the Past

One new exponential technology allowed us to evolve from analog applications to digital applications of the old functions

The convergence of multiple exponential technologies spawned entirely new applications previously not possible – and to most of us

Old Application: Typewriter, Calculator, etc.

1 New Tech: IBM

New Application: Word Processing, Spreadsheets, etc.

Combine IBM + WWW

BUT and we get E-COMMERCE, Social Media, etc.

This was Interesting. Now This was FASCINATING!

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Where Does Electrification of Transportation Go Next?

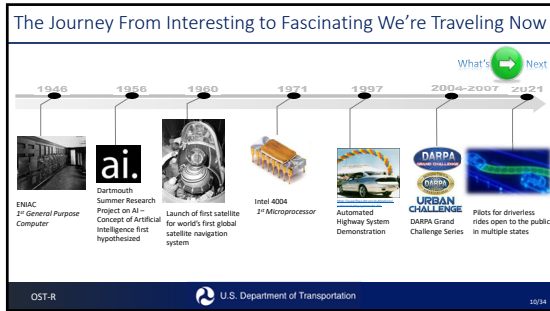
What's Next

Level n DC Fast Charging

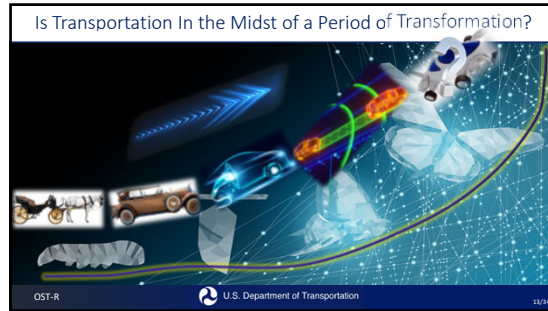
Advanced Air Mobility

INDUCTIVE CHARGING

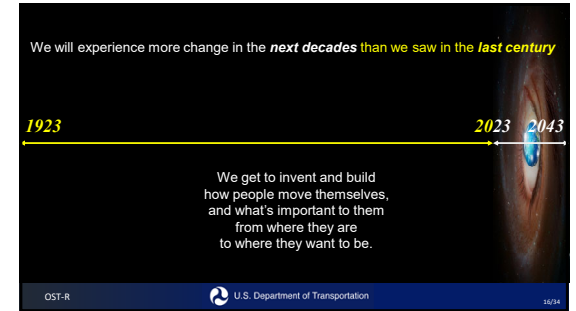
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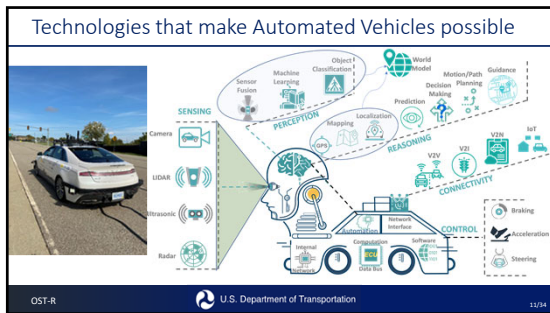
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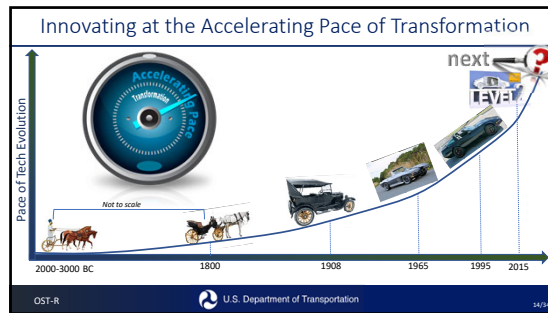
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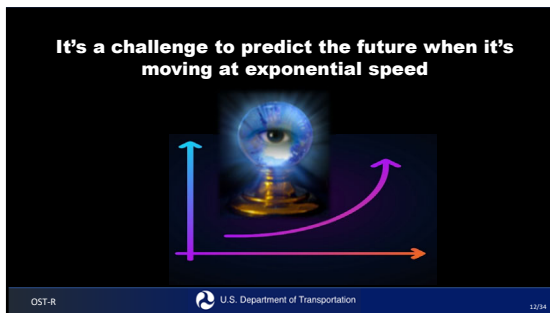
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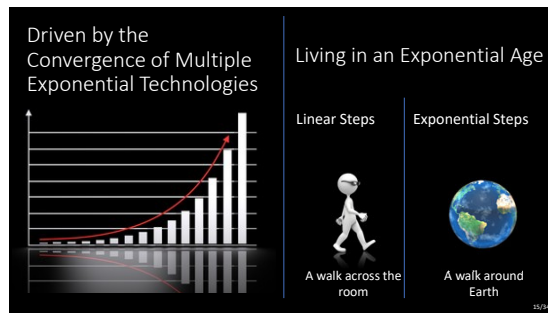
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**Advanced Propulsion Systems**

- High Thrust, High Efficiency
- Advanced Materials
- Lightweight Structures
- Advanced Manufacturing

**Sustainability**

- Electric Power
- Hydrogen Fuel Cells
- Battery Storage

**Autonomous Systems**

- Advanced Sensors
- AI/ML Algorithms
- Real-time Data Processing
- Secure Communications

**Advanced Materials**

- Carbon Fiber Composites
- Aluminum-Lithium Alloys
- Advanced Polymers
- Advanced Composites

**Advanced Manufacturing**

- 3D Printing
- Advanced Machining
- Automated Assembly
- Advanced Welding

**Advanced Infrastructure**

- High-Speed Rail
- Advanced Airports
- Advanced Ports
- Advanced Roadways

**Advanced Control Systems**

- Advanced Navigation
- Advanced Traffic Management
- Advanced Air Traffic Control
- Advanced Port Management

**Advanced Security**

- Cybersecurity
- Physical Security
- Advanced Threat Detection
- Advanced Incident Response

**Advanced Operations**

- Advanced Scheduling
- Advanced Resource Allocation
- Advanced Performance Monitoring
- Advanced Customer Service

**Advanced Research & Development**

- Advanced Simulation
- Advanced Testing
- Advanced Prototyping
- Advanced Collaboration

**Advanced Standards & Compliance**

- Advanced Certification
- Advanced Regulatory Compliance
- Advanced Safety Standards
- Advanced Environmental Standards

**Advanced Training & Education**

- Advanced Pilot Training
- Advanced Air Traffic Controller Training
- Advanced Port Operations Training
- Advanced Roadway Maintenance Training

**Advanced Innovation & Partnerships**

- Advanced Industry Partnerships
- Advanced Academic Partnerships
- Advanced Government Partnerships
- Advanced International Partnerships

**Advanced Future Vision**

- Advanced Smart Transportation
- Advanced Sustainable Transportation
- Advanced Autonomous Transportation
- Advanced Connected Transportation

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### Transportation System of the Future

Integrated, connected, intelligent, interoperable, resilient

**Space Domain**

**Aviation Domain**

**Surface Domain**

The bright lines that once separated transportation domains are dissolving

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### Let's Build a Shared Sense of What the Future Should Be

**The transportation System of the Future**

If we collaborate for a shared vision of the future through a new lens, we can shape an amazing future

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### From Data to Intelligence & AI Opportunities

**Data Centricity**

**Data** → **Information** → **Knowledge** → **Wisdom** → **Intelligence**

Data Harvesting & Analysis → Execution & Outcome

**Computing & Software**

The transportation system will be awash in DATA

We need **AI/ML/Analytics** to translate that data to actionable intelligence

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### Digital Infrastructure & Connectivity will Take Center Stage

With networks acting as the connective tissue stitching together the system

And the data acting as the lifeblood flowing & navigating the system

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### It will be our choice how far we drive transformation

- Investments (research & infrastructure)
- Talents
- New & emerging technologies
- Excitement about the future
- The will to collaborate
- Education & Workforce Development

And break down the silos between academic disciplines

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### The Transportation System of Recent Past

Systems did not interoperate

**Space Domain**

**Aviation Domain**

**Surface Domain**

Bright lines separated transportation domains

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### We Have the Techs & Players

We have the technology getting close to deployment-ready maturity

We have the players in the game ready to move the tech to deployment

SO...WHAT ARE WE MISSING?

**WHAT GOES HERE**

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### Time for Action!

**CURRENT STATE**

- 42,915 motor vehicle traffic fatalities in 2021
- 115,018 cancelled flights in 2021
- The Transportation Sector generates more greenhouse gas emissions than any other sector in the U.S.

**FUTURE STATE**

JOURNEY TO ZERO

Together, we can transform transportation

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RESEARCH, DEVELOPMENT AND TECHNOLOGY  
**STRATEGIC PLAN**  
Fiscal Years 2022 - 2026  
Building a Better Transportation Future for All

- ✓ Strategic vision
- ✓ Priorities & strategies to guide research
- ✓ Technology commercialization and deployment

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**34 New Transformative Centers (UTCs)**

- 10 Mobility
- 7 Safety
- 4 Cybersecurity
- 1 Congestion
- 1 Transportation System
- 5 Environment
- 6 Infrastructure

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**THANK YOU!**

<https://www.transportation.gov/rdtstrategicplan>

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RESEARCH, DEVELOPMENT AND TECHNOLOGY  
**STRATEGIC PLAN**  
Fiscal Years 2022 - 2026  
Building a Better Transportation Future for All

*"We envision a people-centered transportation system that provides safe, accessible, reliable, and sustainable transportation for all ...."*

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**Sample UTC Innovations**

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Advancing Research through the Bipartisan Infrastructure Law

USDOT is investing in the future

- University Transportation Centers (UTCs)
- Advanced Research Projects Agency for Infrastructure (ARPA-I)
- SMART - Strengthening Mobility and Revolutionizing Transportation
- Other programs

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**The Future is Within Reach – Let's Get There**

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