



Go Further

FORD PERSPECTIVES ON MOBILITY & AUTONOMY

Mobile Sources Technical Review Subcommittee

Washington, DC

October 18th, 2016

***Presented By: John Viera, Global Director
Sustainability and Vehicle Environmental Matters***

A large, white, stylized script logo of the word "Ford" set against a background of blue, wavy, geometric patterns.

Changing Global Societal Trends



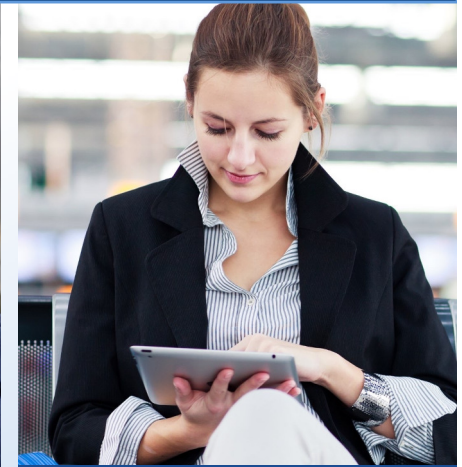
Urbanization



Global Middle Class Growth



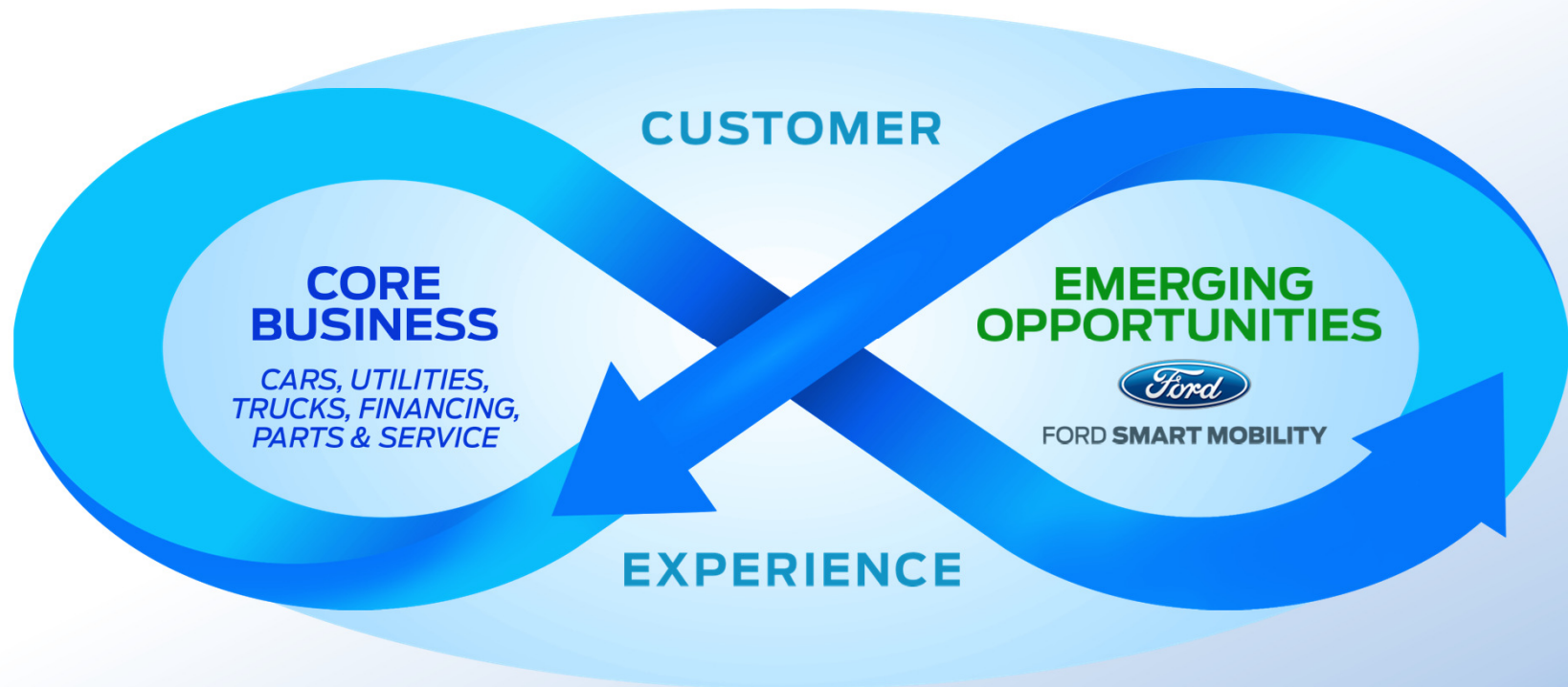
Air Quality



Changing Consumer Attitudes

Changing Societal Trends Will Shape The Future Of Our Industry, And Will Transform The Way We View Innovation And Mobility

Fortifying And Transforming Core Business Enables Expansion Into Emerging Opportunities



2015/16 Sustainability (17th Annual) Report



“Contributing to a better world always has been a core value at Ford, and our commitment to sustainability is a key part of our company DNA. Ultimately, our vision is to make people’s lives better by changing the way the world moves, just as Henry Ford did more than a century ago.”



“With sustainability deeply embedded in our overall strategy, we remain committed to running a strong and responsible business that treats our customers, our employees, our communities and our planet with respect.”

While Our Industry & World Continue To Evolve Faster Than Ever, Our Entire Team Remains Fully Committed To Keeping Sustainability At The Heart Of Our Strategy

Ford Smart Mobility Strategy



Changing how
the world
moves...
again.

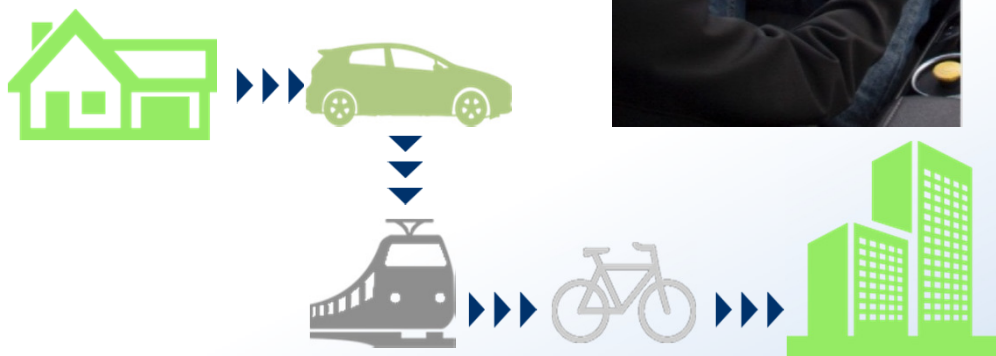
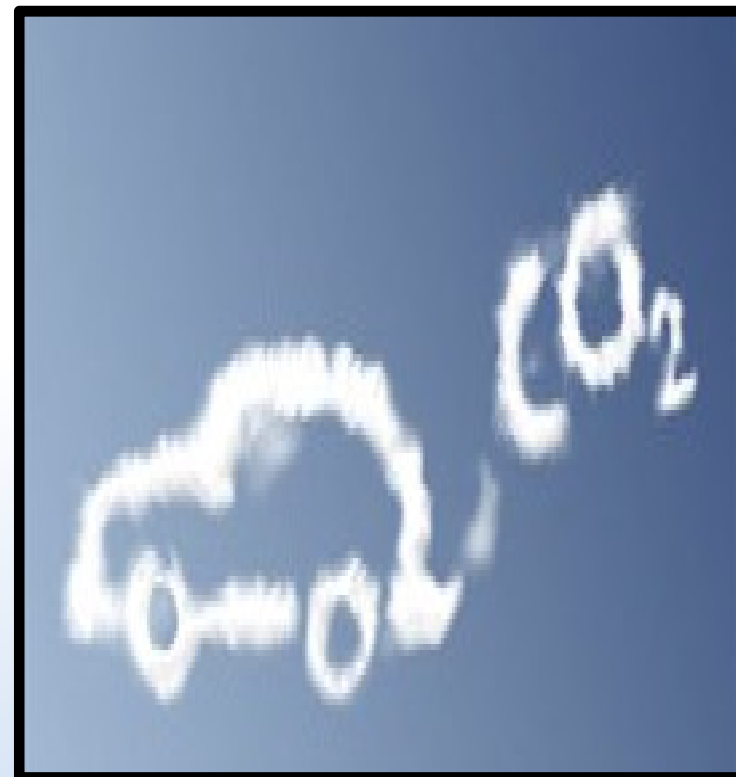


Leverage Insights Across Connectivity, Autonomy, & Full-service Mobility Solutions To Provide Innovative Experiences Loved By Customers, Enabling A Better World



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Mobility Solutions And Fuel Economy / CO₂



Innovations To Help Complement Vehicle Technology Improvements to Address CO₂ Reductions




Our New Common Data And Analytics Platforms Are Also The Foundation For Emerging Opportunities



Connectivity

Vehicle Performance Insights


- + Vehicle prognostics
- + Vehicle diagnostics
- + Driver behavior



Mobility Solutions

Mobility

- + Dynamic shuttle
- + GoDrive
- + GoPark
- + Data / Yield management
- + FordPass



Autonomous Vehicles

Autonomous and Driver Assist Technology

- + Advanced driver assistance systems
- + Computer vision for vehicle perception
- + Deep learning for autonomous driving
- + Sensor fusion



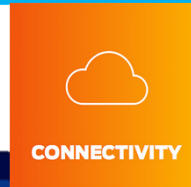
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Connectivity

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Connectivity Blueprint



Near-Term

Build on SYNC, MyLincoln Mobile and MyFord Mobile



Powered by Microsoft



Mid-Term

Connect Vehicles And Expand Capabilities

Embedded Modem
Connected Vehicles
Global Infrastructure



Long-Term

Fully Integrated Connectivity



Experiences Get Better Over Time

Business Model Development And Implementation

Gaining A Better Understanding Of How Customers Use Their Vehicles Will Enable Development Of Products, Services And Experiences That Excite And Delight, As Well As Enhance Sustainability



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Mobility

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Innovation In Mobility



MOBILITY



Go Further

Facilitate Flexible Ownership & Usership



CAR SHARING

\$\$\$



FRACTIONAL OWNERSHIP



PAY-AS-YOU-GO SOLUTIONS

Provide Multi-Modal Urban Solutions

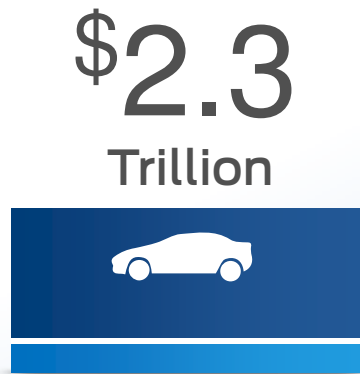


Smart Mobility Key Strategic Areas: Flexible Use & Ownership Of Vehicles, And Multi-Modal Transportation

Transforming To Auto And Mobility Company Allows Significant Revenue Growth Potential



Ford Share
6%



Traditional Auto Revenue

\$5.4 Trillion



Other Transportation Services Revenue

Ford Share
0%

The Move From Traditional

Each minute in the
U.S. ...



New vehicles
sold



9 million miles traveled



125K taxis / Ubers on the road



60K “shared” rides



450K bytes of vehicle data from
a connected vehicle



500K+ gigabytes of data
transmitted on the Internet

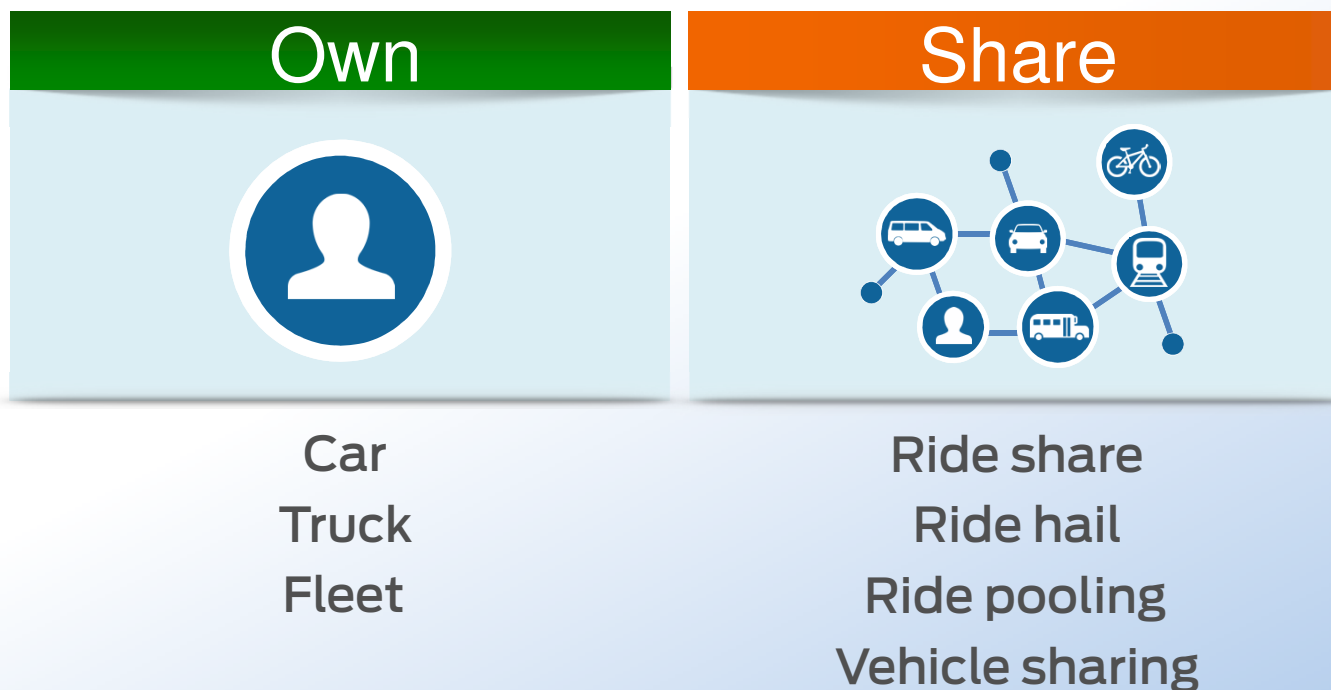


350K cell phone apps
downloaded

Source: Estimates based on government and industry data

There Are Significant Opportunities For Participation In Far More Transactions

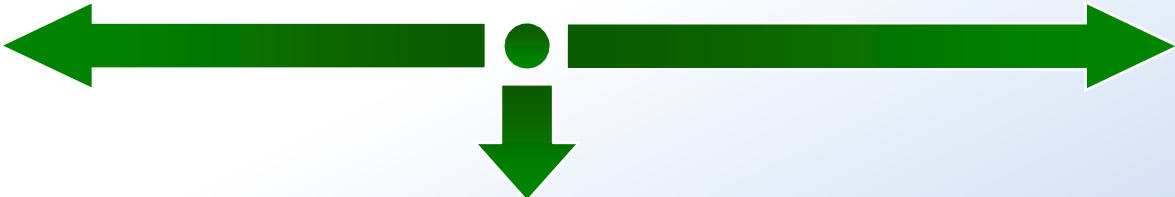
Our Traditional Business Is Selling Cars To Individuals And Fleets; Our Emerging Businesses Are About Providing Transportation For Passengers And Goods





We See A New Business Model By Leveraging Our History To Take Advantage Of The Full Mobility Value Chain

Ford's Historical Orientation



Ford's Mobility Orientation

What We've Done So Far...In Mobility...

Ford Smart Mobility



- ✦ Consumer experience
- ✦ Flexible usership
- ✦ Social collaboration
- ✦ Open innovation
- ✦ Technical developments
- ✦ Established an independent, new Ford entity



Greenfield Labs



- ✦ Draws on existing Ford resources and selected new talent
- ✦ Focuses on consumer experience in shared transportation
- ✦ Explores and launches new businesses using design thinking methodology



New Announcements



New City Solutions organization to foster low-friction multi-modal travel in cities



Purchase of Chariot – Bay area shuttle-based commuter transit









Ford GoBike

Partnership in San Francisco with Motivate Bike Share

Part Of A Mobility System For Customers And Cities





Layers of value in mobility


-  9 million miles traveled
-  125K taxis / Ubers on the road
-  60K “shared” rides
-  450K bytes of vehicle data from a connected vehicle
-  500K+ gigabytes of data transmitted on the internet
-  350K cell phone apps downloaded



Where we will play and win

 City solutions

 Chariot
Dynamic shuttle

 Bike sharing

Source: Estimates based on government and industry data



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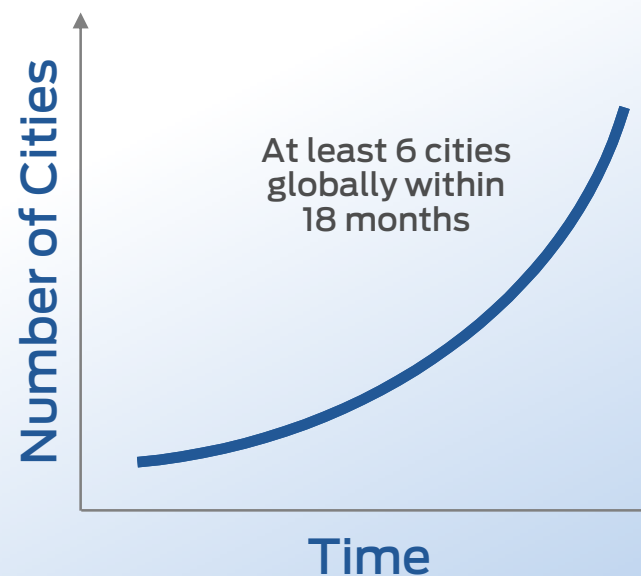
Dynamic Shuttle Services

Market leader in vans and commercial / government fleets

Shuttle will beam route and use information to the cloud for storage and analytical design



Routes are dynamic; driven by user demand. This allows us to produce yield pricing opportunities.

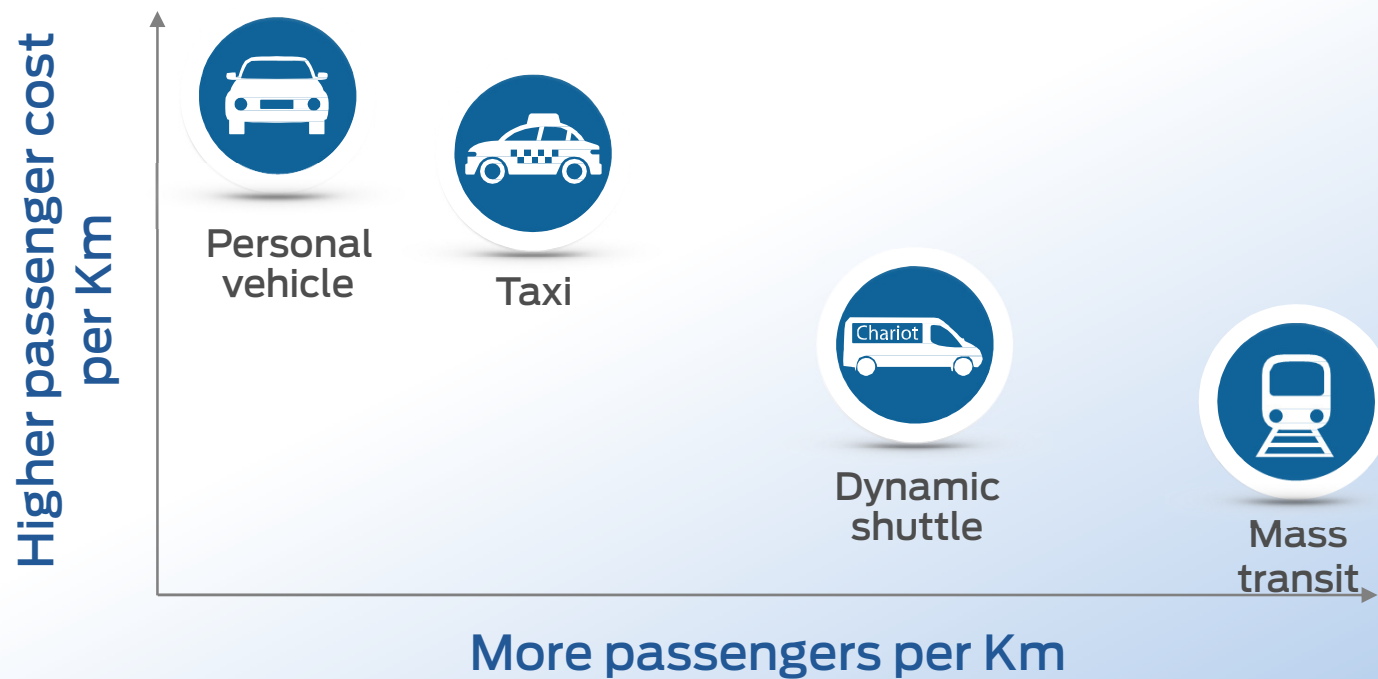


Dynamic Shuttle Leverages Global Van And Fleet Strength With Chariot Acquisition To Grow Rapidly

Dynamic Shuttle Provides Near-Taxi Convenience At A Near-Mass Transit Price



China Market Example



Mobility Key Takeaways

- 1 As we move from our traditional sales business, there are significant opportunities to increase our interactions with many more customers
- 2 Ford Smart Mobility focused on two business models – owned and shared, which will provide transportation for passengers and goods
- 3 Dynamic shuttle will capitalize on Ford’s existing strengths in vans and large fleets
- 4 We are leveraging key technology platforms – connectivity, data / yield management, autonomy – to support the owned and shared business model
- 5 Where to play and win will initially focus on city solutions, dynamic shuttle and data and customer experiences from bike sharing



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Autonomy

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Autonomous – DAT To Full Control

Driver Assist Technologies (DAT)

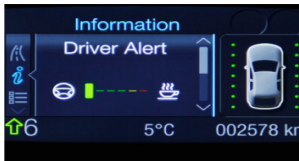
Active Park Assist



Rear Cross-traffic Alert



Lane Departure Warning with Lane Keeping Aid



Blind Spot Monitoring



AUTONOMOUS
VEHICLES



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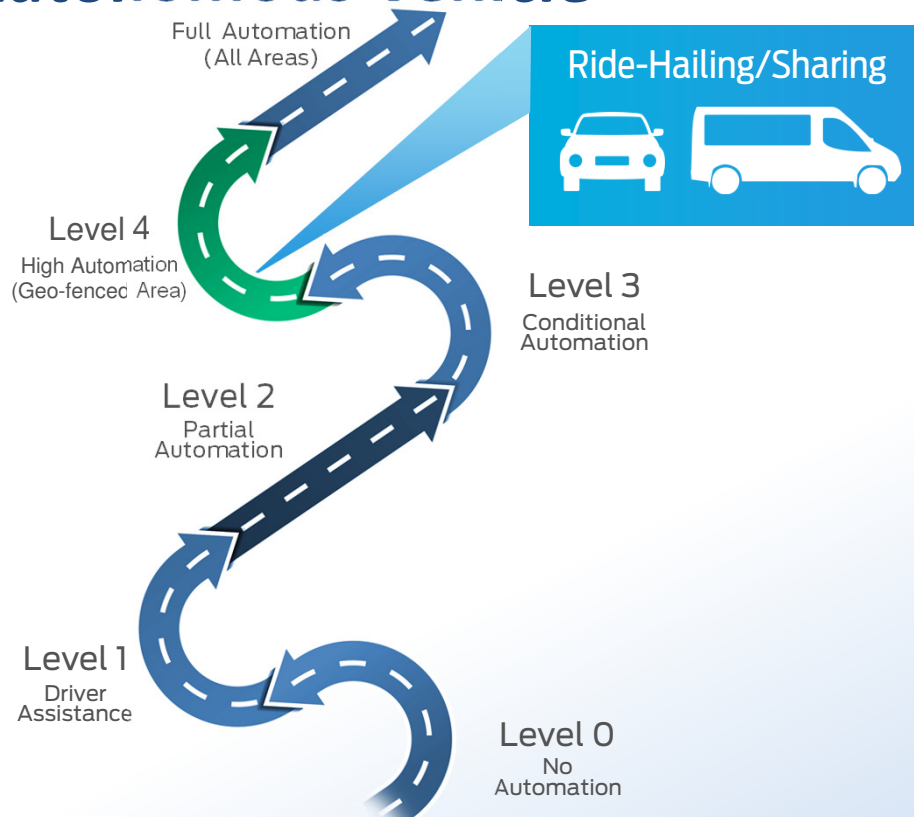


The Transition From Driver Assist Technologies Toward Autonomous Driving Is Progressing Rapidly



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Autonomous Vehicle



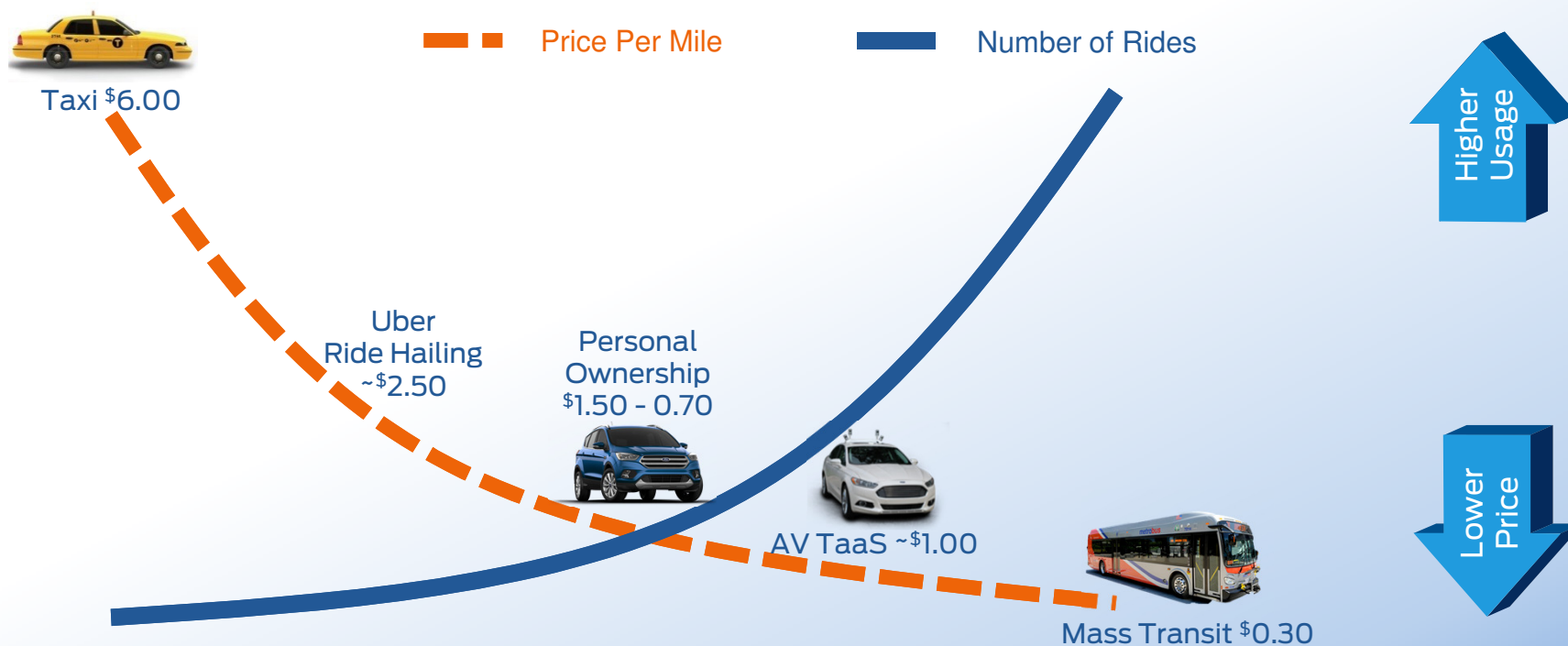
- Announced our intent to have a high-volume, fully autonomous Society of Automotive Engineers (SAE) Level 4-capable vehicle in commercial operation in 2021
- Initial application in a ride-hailing or ride-sharing service, with personal use to follow at a later date
- Vehicle being specifically designed for commercial mobility services without a steering wheel or gas and brake pedals
- Investing or collaborating with four startups on autonomous vehicle development

Focus On High Volume, SAE Level 4

Autonomous Vehicle For Ride-Hailing Or Ride-Sharing In 2021

AV Technology Will Lower TaaS Prices And Increase Access And Usage

Transportation as a Service Evolution



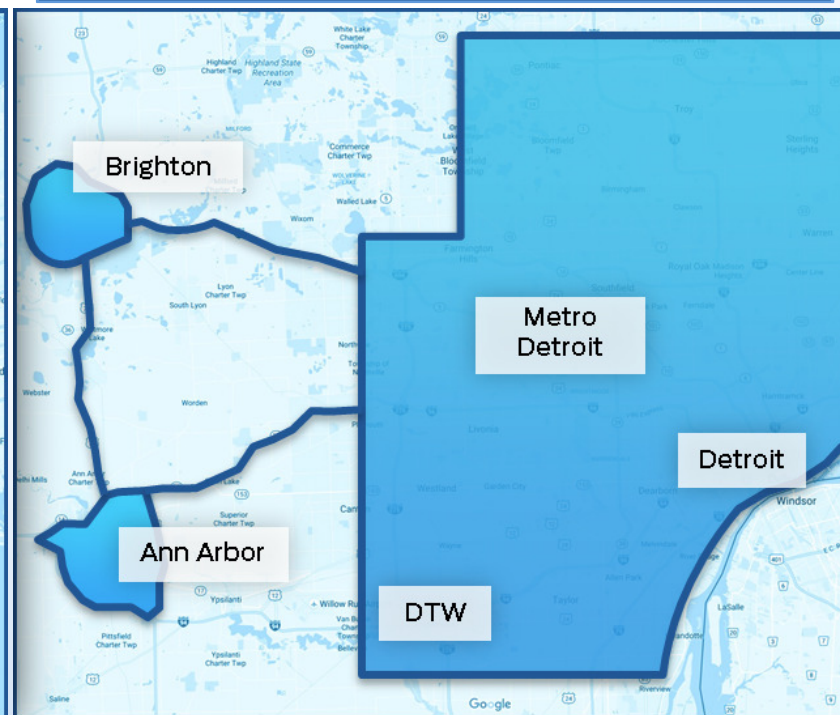
TaaS = Transportation as a Service, point to point mobility for a fee

Initial Deployment Will Be In Large Geo-fenced Urban Markets And With Geo-fenced Corridors

New York City Geo-fenced Area With Corridors



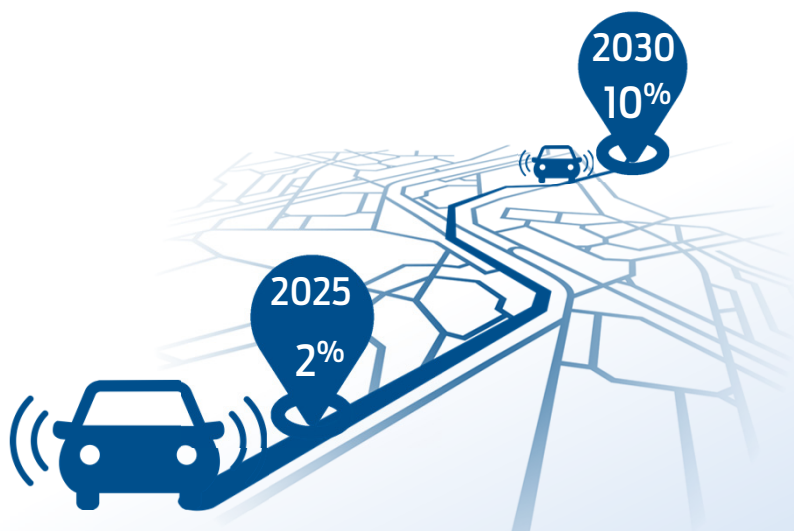
Detroit Geo-fenced Area With Suburbs Linked By Corridors



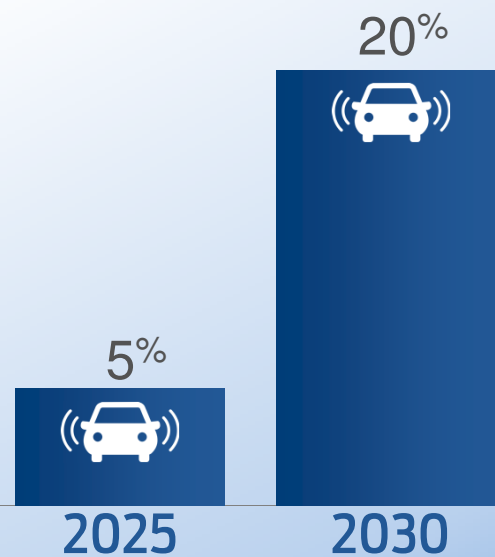


Autonomous Vehicles Might Account For Up To One In 10 Miles Traveled And One In Five Sales

U.S. Autonomous Miles Traveled
(Percent of Total)



U.S. Autonomous Annual Sales
(Percent of Total)



Low Volume AV TaaS Vehicles, In 2018, Pave The Way For A High Volume All-New Product In 2021



2016 2017 2018 2019 2020 2021 2022 2023

Development 30 120 140

Production



SAE Level 4 - With Safety Driver

SAE Level 4 – No Safety Driver Or Controls

Fusion AV

All-New Product

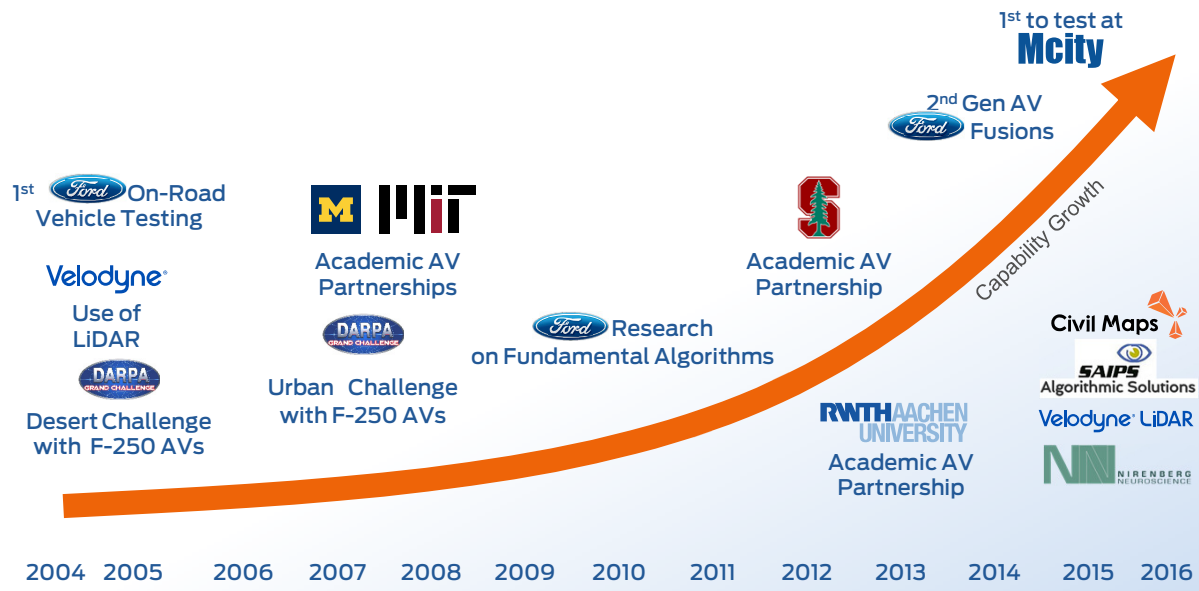


Our Position As A Leading OEM In Autonomous Vehicle Technology Will Allow Us To Lead Commercialization

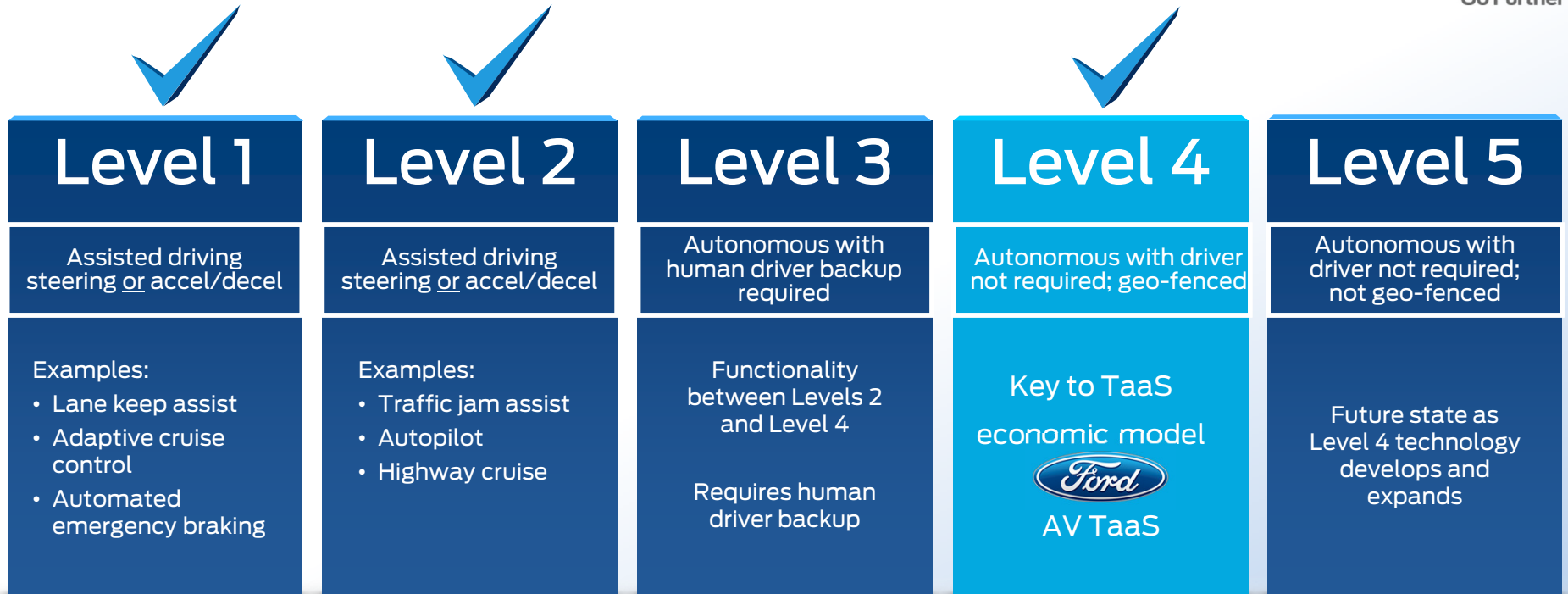


AV Expertise

Advanced and Production Engineering Staffing



Ford To Introduce AV Technology At A SAE Level 4




✓ Ford current focus




Go Further


We Are Using Mediated Perception Methods With Direct Perception To Correctly Determine Driving Solutions




Cameras
Visible sensing for object classification and color recognition



LiDAR
Near-infrared laser detecting and tracking distant and night objects



Ultrasonic
Close proximity




Radar
Radio wave detection of moving objects

Direct Perception
Use of sensors to develop real-time view of environment to use in conjunction with mediated perception to correctly determine driving solutions

Combination of sensors covers the full environment from day to night, from distant to near, from still to moving, from metallic to organic



LiDAR
Real-time localization and 360° environment mapping



HD maps
3D map of geo-fenced area including "rules of the road" and permanent object classification

Mediated Perception
Comparison of real-time LiDAR mapping to existing HD map to determine which direct sensed objects are of concern and which are not

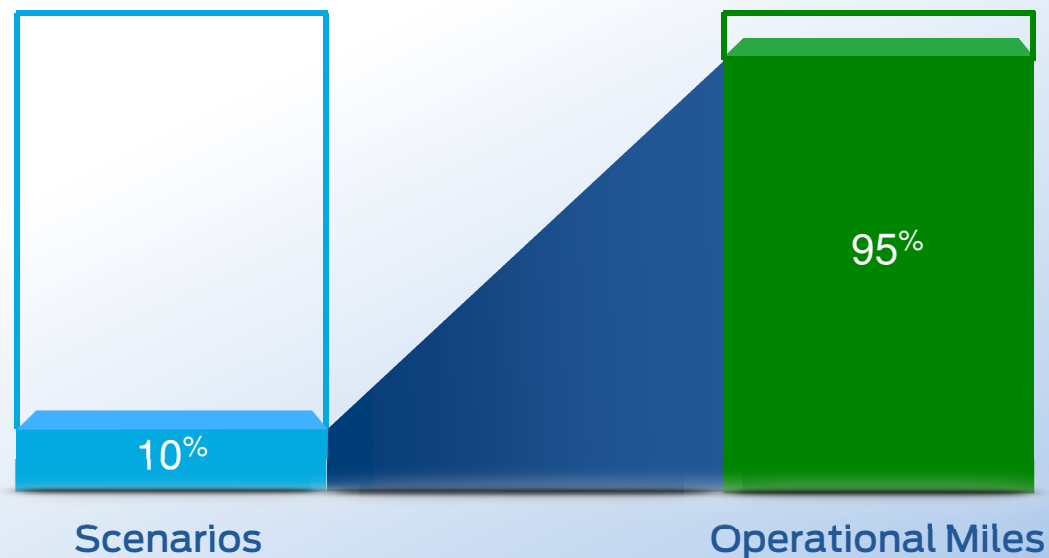
Provides baseline "rules of the road" for driving solutions of current environment



We Are Focusing On Solving Scenarios Instead Of Accumulating Miles

Testing Coverage

- A scenario is a vehicle maneuver in a driving environment combined with 'noise' factors
- Ford is focused on correctly solving the scenarios an AV will encounter in its operational environment
- Mileage accumulation is an outcome, not a goal, of our AV technology development



Scenario Example Illustrates The Benefits Of Our Direct And Mediated Perception Approach

Ford's Approach



Scenario: Making a right turn at a stoplight with a left turn lane in an urban environment with moderate density of pedestrians and vehicles

- 3D maps lay the foundation (rules of the road and fixed objects in the environment)
- LiDAR is primary sensor for localization and for providing a real-time 360° view of the environment and objects at long distances
- Radars, cameras and LiDARs combine to identify and track moving objects
- Cameras provide short to mid-range object and scene characterizations
- The Virtual Driving System integrates the 3D map and direct perception data to create a more robust mediated perception

Autonomy Key Takeaways

1

Ford believes the potential for the AV business is very large

2

Ford has been a leading player in AV technology development for more than 10 years

3

Ford is testing Level 4 AVs with safety drivers on the road right now

4

Ford is in a unique position to marry our AV technology expertise with our proven ability to commercialize at scale in the automotive environment

5

Ford intends to have a high volume, dedicated Level 4 AV in production in 2021

6

Ford's initial approach will support AV Transportation as a Service



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Our Sustainability



GREAT PRODUCTS – STRONG BUSINESS – BETTER WORLD



Ford