NATURALISTIC STUDY OF LEVEL 2 DRIVING AUTOMATION FUNCTIONS

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PROJECT OVERVIEW

Objective

- **Investigate driver interaction with market-ready partial driving automation through a naturalistic driving study (NDS)**
  - **Evaluate how drivers operate vehicles equipped with partial driving automation**
  - **Monitor internal vehicle data relevant to targeted functions**
  - **Evaluate how drivers operate vehicles equipped with partial driving automation during longer drives**

RESEARCH QUESTION FOCUS AREAS

- Driver Performance
- Driver Engagement
- System Performance
- Driver-System Interaction

- Integrated into focus areas as appropriate
  - Driver interface design
  - Unintended or Improper use
    - Misuse and/or abuse
  - Unintended consequences
  - Safety and security
  - System failures
  - Licensing and training

2017 AUDI Q7

- **Driver Assistance Package**
  - Adaptive cruise control
  - Active lane assist
  - Congestion assist
  - Lane departure warning
  - Side assist
  - Audi pre-sense

2015 INFINITI Q50

- **Dynamic Driver Assistance**
  - Intelligent Cruise Control w/ Distance Control Assist
  - Active Lane Control
  - Lane Departure Warning & Prevention
  - Blind Spot Warning & Prevention

2016 MERCEDES-BENZ E350

- **Driver Assistance Package**
  - DISTRONIC PLUS with steering assist
  - PRE-SAFE brake with pedestrian recognition
  - BAS PLUS with cross-traffic assist
  - Active blind spot assist
  - Active lane keeping assist

2015 TESLA MODEL S

- **Autopilot Tech Package**
  - Traffic-Aware Cruise Control
  - Autosteer
  - Auto Lane Change

2016 VOLVO XC90

- **Convenience Package**
  - Adaptive cruise control
  - Lane keeping aid
  - Pilot Assist

PROJECT OVERVIEW

- **10 vehicles with partial driving automation**
- **120 participants, balanced for age and gender**
- **4-week participation period**
- **Northern Virginia/Washington, DC area**
- **Compensation up to $500**

RECRUITMENT

- **Recruit 120 drivers from the Northern Virginia/Washington, DC region**
- **Equal number of males and females ages 25-39 years old and 40-54 years old**
- **Screening for 1,200 miles per month**
- **Incentive to drive at least 1,200 miles during participation**
- **Targeting ~15,000 mi per year for each vehicle**
- **FHWA (2015) national average is 13,476 per year**

DAS VIDEO VIEWS

- **Forward view**
- **Driver face**
- **Over the shoulder (OTS)**
- **Foot well (pedals)**
- **Rear view**
- **Instrument cluster (HMI)**

DATA REDUCTION VARIABLES

Driver variables

- Non-driving task engagement, drowsiness/impairment, etc.
- Visual behavior

Vehicle variables

- Speed, lane position, headway, etc.

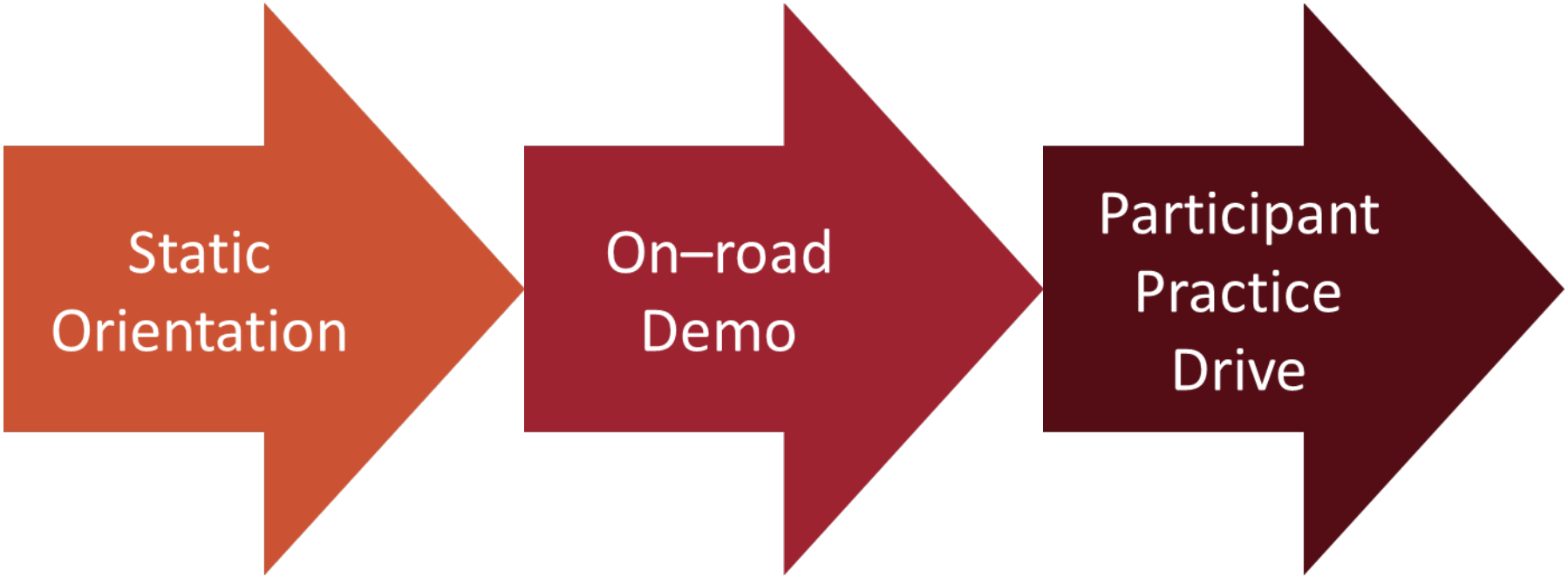
Environmental variables

- Roadway markings, roadway types, traffic density, relation to junction, weather conditions, lighting conditions, etc.

SAMPLING PLAN

Epoch Type	Total Number of Epochs	Estimated Total per Driver	Estimated Frequency per Week per Driver
2 Functions Active	1,440	12	3
1 Function Active	1,440	12	3
0 Functions Active	1,440	12	3
MFA Alerts	1,440	12	3
All SCEs	All	All	All

PARTICIPANT TRAINING



PARTICIPANT TIMELINE

Week 1	• Participants begin driving study vehicle
Questionnaire	• Subjective experience and trust
Week 2	
Questionnaire	• Subjective experience and trust
Week 3	
Questionnaire	• Subjective experience and trust
Week 4	
Questionnaire & Debrief	• Post-drive questionnaire • Payment
Vehicle Prep	• Vehicle inspection, cleaning and prep • Data ingestion

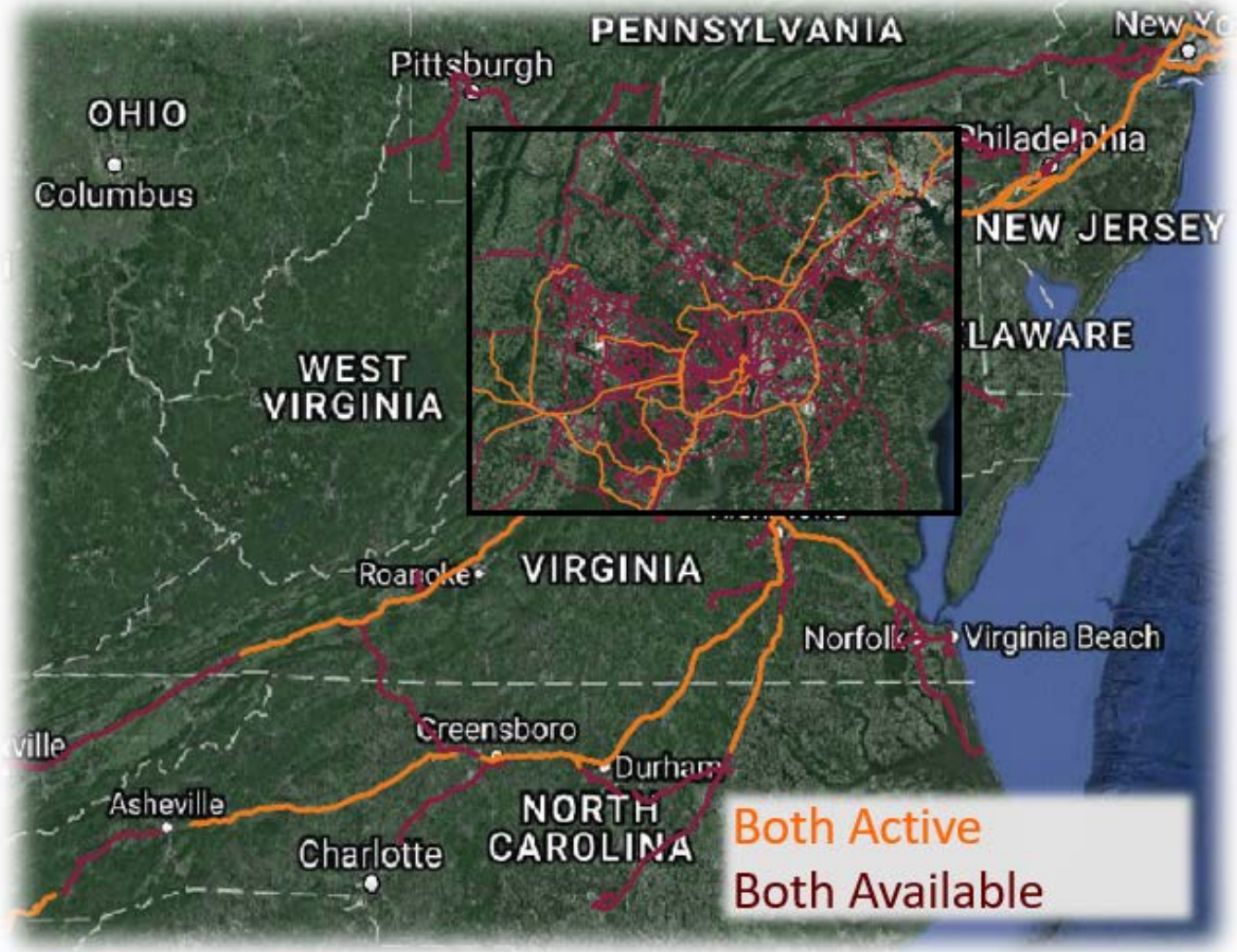
PROJECT STATUS

- **All 120 participants completed as of December, 2017**
- **Data analysis and reduction continuing**
- **Long Drive sub-study awarded May 2017**
  - Uses additional Tesla Model S to investigate automation use and driver behavior on ~4-hour drives
  - Data collection currently underway
- **Final Report due to NHTSA July 2018**

Vehicle Exposure

At the end of the study we estimate having:

- **16,000 trips**
- **222,000 miles**
- **On average each participant drives ~1,800 miles during the 4-week exposure**



Safety Critical Event

Questions?

Thank You!

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