Perspective on Voluntary Safety Self-Assessments

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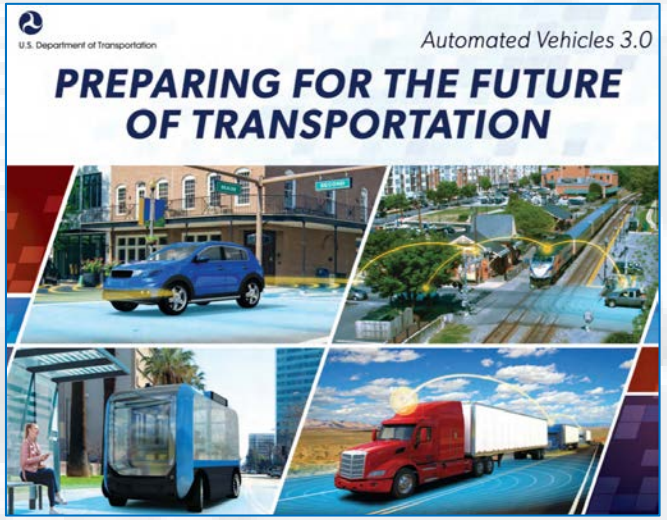
U.S. DOT PREPARING FOR THE FUTURE OF TRANSPORTATION – AUTOMATED VEHICLES 3.0

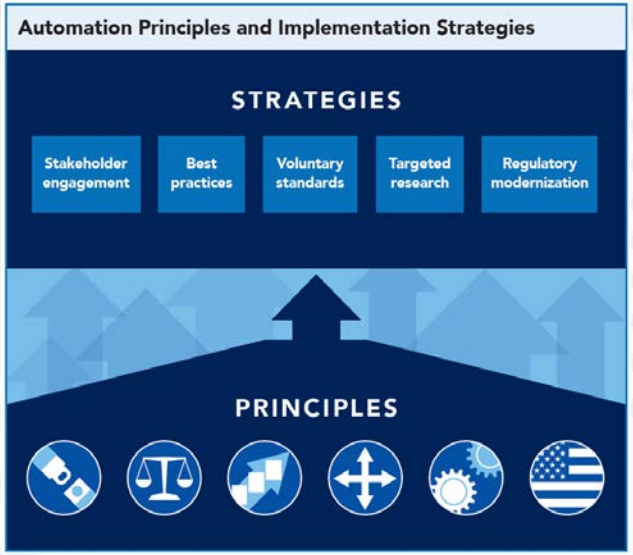
Provides:

1. New multimodal safety guidance
2. Clarifies policy and roles
3. Outlines how to work with U.S. DOT as automation technology evolves



Reaffirms and maintains that:

1. A Vision for Safety 2.0 on the design, testing, and safe deployment of ADS remains central to U.S. DOT's approach.
2. U.S. DOT's primary focus is SAFETY.



U.S. DOT Automation Principles

U.S. DOT has established a clear and consistent Federal approach to shaping policy for automated vehicles, based on the following six principles.

1. We will prioritize safety.

2. We will remain technology neutral.

3. We will modernize regulations.

4. We will encourage a consistent regulatory and operational environment.

5. We will prepare proactively for automation.

6. We will protect and enhance the freedoms enjoyed by Americans.

VOLUNTARY SAFETY SELF-ASSESSMENTS (VSSAs)

- VSSAs are intended to demonstrate to the **public** that entities are:
  - Considering the safety aspects of ADSs
  - Communicating and collaborating with USDOT
  - Encouraging the self-establishment of industry safety norms for ADSs
  - Building public trust, acceptance, and confidence through transparent development and testing of ADSs.

INTENDED USE AND SCOPE OF VSSAs

Submission of VSSA is voluntary - not a requirement for testing

Gives companies an opportunity to showcase their approach to safety, without revealing IP

Supports transparency with consumers and the general public

Encourages sharing of best practices and methods

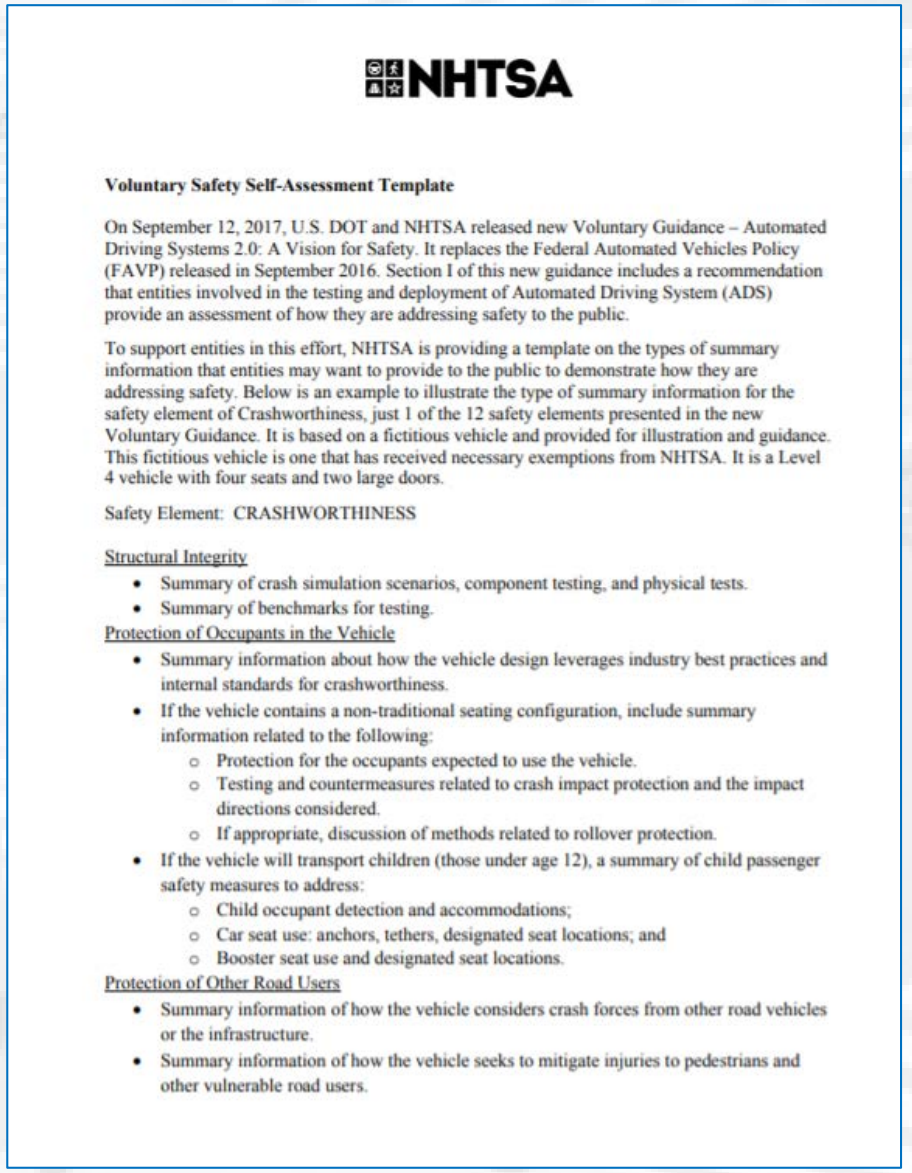
12 Safety Elements

Companies are encouraged to consider and document their approach to safety.

1. Vehicle Cybersecurity 2. System Safety 3. Operational Design Domain 4. Object and Event Detection and Response 5. Fallback (Minimal Risk Condition) 6. Validation Methods	7. Human Machine Interface 8. Crashworthiness 9. Post-Crash ADS Behavior 10. Data Recording 11. Consumer Education and Training 12. Federal, State, and Local Laws

STRUCTURING THE VSSA

- NHTSA provided a template for VSSA
- Template design accommodates the range and diversity of entities that are currently testing ADS
- Template was flexible – not prescriptive
- Provides guidance and an example of the types of summary information that could be shared



NHTSA

Voluntary Safety Self-Assessment Template

On September 12, 2017, U.S. DOT and NHTSA released new Voluntary Guidance – Automated Driving Systems 2.0: A Vision for Safety. It replaces the Federal Automated Vehicles Policy (FAVP) released in September 2016. Section I of this new guidance includes a recommendation that entities involved in the testing and deployment of Automated Driving System (ADS) provide an assessment of how they are addressing safety to the public.

To support entities in this effort, NHTSA is providing a template on the types of summary information that entities may want to provide to the public to demonstrate how they are addressing safety. Below is an example to illustrate the type of summary information for the safety element of Crashworthiness, just 1 of the 12 safety elements presented in the new Voluntary Guidance. It is based on a fictitious vehicle and provided for illustration and guidance. This fictitious vehicle is one that has received necessary exemptions from NHTSA. It is a Level 4 vehicle with four seats and two large doors.

Safety Element: CRASHWORTHINESS

Structural Integrity

- Summary of crash simulation scenarios, component testing, and physical tests.
- Summary of benchmarks for testing.

Protection of Occupants in the Vehicle

- Summary information about how the vehicle design leverages industry best practices and internal standards for crashworthiness.
- If the vehicle contains a non-traditional seating configuration, include summary information related to the following:
  - Protection for the occupants expected to use the vehicle.
  - Testing and countermeasures related to crash impact protection and the impact directions considered.
  - If appropriate, discussion of methods related to rollover protection.
- If the vehicle will transport children (those under age 12), a summary of child passenger safety measures to address:
  - Child occupant detection and accommodations;
  - Car seat use: anchors, tethers, designated seat locations; and
  - Booster seat use and designated seat locations.

Protection of Other Road Users

- Summary information of how the vehicle considers crash forces from other road vehicles or the infrastructure.
- Summary information of how the vehicle seeks to mitigate injuries to pedestrians and other vulnerable road users.

VSSAs: INDUSTRY DISCLOSURES TO DATE

NHTSA/USDOT have been strongly encouraging companies to disclose VSSAs in working to establish public trust and confidence in the technology. **16 VSSAs currently released and publicly available:**

- Apple
- Aurora
- AutoX
- Ford
- GM
- Mercedes-Benz/Bosch L4-L5
- Mercedes Benz L3
- Navya
- Nuro
- Nvidia
- Robomart
- Starsky Robotics
- TuSimple
- Uber
- Waymo
- Zoox

Published VSSAs can be viewed on NHTSA's Index at
*https://www.nhtsa.gov/automated-driving-systems/voluntary-safety-self-assessment

WHAT ARE WE LEARNING SO FAR?

VSSAs received are:

- Providing visibility into ADS development and testing activities across the industry
- Giving a narrative around how a company addresses each safety element, describing processes followed, standards used, and examples of how it operationalizes each area in their development and testing processes
- Communicating a company's vision for ADS and approach to safety
- Educating and informing stakeholders and the public about ADS
- Showing variation in the level of detail provided (some take a more basic approach while others discuss each safety element at length)

Example Excerpts from VSSAs: Discussing Fallback or Minimal Risk Condition

"In the event of a collision, or a critical fault of the safety controller, the vehicle will execute a *fallback stop*. This action brings the vehicle to rest quickly but allows surrounding actors time to respond accordingly, while also avoiding hazards that may result from attempting a rapid stop. The fallback stop enables hazard lights, engages the horn, holds the steering in its last commanded position, and applies a constant deceleration until the vehicle comes to a stop. "

"When a malfunction occurs, the vehicles dynamically sort potential responses into one of any number of fail-functional or fail-safe states. Minor faults not affecting the ability to drive are flagged for later resolution while more serious conditions might entail the decision to securely stop at a waypoint a short distance away, on the shoulder at the next opportunity or immediately. "

"Beyond safety drivers, we have also developed a layered system fallback strategy that can support full self-driving in our vehicles, without requiring human intervention. At all times, our onboard, high-reliability computer calculates multiple potential trajectories that would be safe to take should a system fail. If, for example, a sensor were to malfunction, our vehicle could safely pull over to the side of the road or lane using a trajectory calculated before the malfunction, when the system had full information."

"Should a malfunction occur, the diagnostics system determines whether the appropriate response is a fail-operational state or a fail-safe state, and transitions the vehicle to the corresponding safe state. When required, the self-driving system will operate the vehicle at a reduced speed or pull to the side of the road and execute a safe stop, as appropriate."

PUBLIC NOTIFICATION OF PETITIONS

- RFCs on 2 petitions for exemption (closed May 20, 2019)
  - GM
  - Nuro

We continue to remain in step -- without getting ahead of -- the developing technology

Safety Research

Technical

- •Unintended Regulatory Barriers
- •Safety Assurance Tools and Methods
- •Alternative Metrics and Safety Assessment Models
- •Crashworthiness in alternative vehicle designs

Behavioral

- •Interactions with humans inside and outside of vehicle
- •Public Acceptance

Communications-Related

- •Confusion over types of systems and stages of systems

Safety without Regulatory Barriers - Rulemaking

Removing Regulatory Barriers for Innovative Motor Vehicle Technologies: ANPRM published May 2019

Safety Principles for ADSs: New (2019 Spring Agenda)

Occupant Protection for ADSs: New (2019 Spring Agenda)

Considerations for Telltales and Indicators: New (2019 Spring Agenda)

Update Exemptions Process

Automated Driving Systems Pilot

Public Education

Now: Advanced cruise control feature awareness and consistent terms

Preparing for testing: Law enforcement and first responder awareness

Public awareness of testing and deployment

Eventually: Safe road users education

THANK YOU!

For More Information:
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