


# PROGRAM PROGRESS PERFORMANCE REPORT

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PPPR #1

SAFE-D: SAFETY THROUGH DISRUPTION UNIVERSITY TRANSPORTATION CENTER



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# Accomplishments

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## Major Goals of the Program

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Fueled by the inevitable changes in our transportation system, the Safety through Disruption (Safe-D) National University Transportation Center (UTC) endeavors to maximize the potential safety benefits of disruptive technologies through targeted research that addresses the most pressing transportation safety questions. With the outstanding leadership of the Virginia Tech Transportation Institute (VTTI) and the Texas A&M Transportation Institute (TTI) in a mentoring collaboration with the new transportation research group at San Diego State University (SDSU), a Hispanic-Serving Institution known for educating the transportation workforce, our geographically balanced consortium encompasses the largest collection of transportation safety researchers in the nation and provides unparalleled expertise, facilities, and resources to conduct impactful research towards our long-term vision. The Safe-D National UTC focuses its efforts in three key areas: (1) cutting-edge research by leading transportation safety experts and their students; (2) education and workforce development with programs for all levels from grade school through college and extending to continuing education for professionals; and (3) fully supported technology transfer, including practitioner training partnerships, social networking, commercialization, and intellectual property management.

## Accomplishments During This Reporting Period

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### Initial Research Project Awards

In the Safe-D grant application, seven collaborative research projects were proposed for an early start. After award, the research teams completed a full proposal process, including the submission of research statements, review and comment by the Safe-D Leadership Team, a follow-on submission of full work plans, and finally, project selection and award. These projects are listed in the Research Project Awards and Activity section below.

### Safe-D Spring 2017 Informational Meeting and Call for Proposals

In addition, Safe-D held its first Call for Proposals in the Spring of 2017. After the formal call for proposals was disseminated among university researchers, those expressing interest were invited to a virtual Informational Meeting, where the details of the Safe-D Proposal Process were discussed, including:

- Safe-D National UTC Overview
- Research Program and Project Examples
- Education and Workforce Development (EWD) Program and Project Requirements
- Technology Transfer (T2) Program and Project Requirements
- Safe-D Researcher Portal
- Safe-D Proposal Process

Safe-D received 22 Research Statements from interested researchers across the consortium of universities, which included many collaborative projects. After the initial review process, 12 projects were selected, and research teams were invited to develop full Work Plans. After receiving careful guidance by the Safe-D Leadership Team in developing these proposals, nine projects were ultimately selected for award under the Spring 2017 Call for Proposals, and awards were made on April 28, 2017. These projects are listed in the Research Project Awards and Activity section below.

### **Research Project Awards and Activity**

During this reporting period, the Safe-D National UTC awarded 22 competitive research projects in the four theme areas of Connected Vehicles, Automated Vehicles, Transportation as a Service, and Big Data Analytics. The Safe-D Leadership Team feels strongly that the research projects that were selected all contribute to the overall Safe-D vision and mission, and are excited about the potential impacts that this research in disruptive technologies will have on maximizing the safety of these technologies as they are integrated into our transportation system.

Projects are identified using a numbering scheme where the first number refers to the award round (e.g. Initial Projects: “Project 01-xxx”). Research statement submissions are also numbered as they are received by Safe-D, without regard to the award round, and are identified by the second number. Research projects with activity during this reporting period, along with respective theme area(s) and short descriptions, are reported below [\*denotes lead institution]:

#### **Project 01-001: [Big Data Methods for Simplifying Traffic Safety Analyses](#)**

*Institution(s): TTI\*, VTTI, SDSU*

*Award Round and Date: Initial Projects 3/16/2017*

*Theme Area(s): Big Data Analytics*

Data used for safety analyses have unique characteristics that are not found in other areas of research. For example, one important characteristic that has been recently documented in the literature is related to datasets that contained a large amount of zero responses, making traditional distributions and regression models inefficient. This project will evaluate statistical and other related methods that could simplify the analysis of the unique attributes related to safety and transportation-related big data and present guidelines for simplifying data analyses.

#### **Project 01-002: [Countermeasures to Detect and Combat Inattention While Driving Partially Automated Systems](#)**

*Institution(s): TTI\*, VTTI*

*Award Round and Date: Initial Projects 3/16/2017*

*Theme Area(s): Automated Vehicles*

This project will investigate and develop countermeasures for problems that can arise when human drivers are required to recognize a fault and assume manual control of a partially-automated vehicle. Researchers at Texas A&M University (TAMU) and TTI will collaborate with researchers at VTTI to complete and integrate two research thrusts that will culminate in the

implementation and testing of a driver cuing system in a partially-automated vehicle on a controlled test track at VTTI.

**Project 01-003: [Data Mining to Improve Planning for Pedestrian and Bicyclist Safety](#)**

*Institution(s): SDSU\*, VTTI, TTI*

*Award Round and Date: Initial Projects 3/16/2017*

*Theme Area(s): Big Data Analytics*

Technological advancement in transportation has been creating new opportunities to explore and investigate new sources of data for the purpose of improving safety planning. This project will investigate data from multiple sources, including automated pedestrian and bicycle counters, video cameras, crash databases, and GPS/mobile applications (both active and passive monitoring), to inform bicycle and pedestrian safety improvements.

**Project 01-004: [Driver Training for Automated Vehicle Technology](#)**

*Institution(s): TTI\*, VTTI, SDSU*

*Award Round and Date: Initial Projects 3/16/2017*

*Theme Area(s): Automated Vehicles*

The goal of this project is to develop training protocol guidelines that can be used by automated vehicle trainers to optimize overall system use and transportation safety. This will be accomplished by first developing a taxonomy of the knowledge and skills required to operate National Highway Transportation Safety Administration (NHTSA) Level 2 and Level 3 automated vehicles.

**Project 01-005: [Factors Surrounding Child Seat Usage in Ride-Share Services](#)**

*Institution(s): VTTI\*, TTI*

*Award Round and Date: Initial Projects 3/16/2017*

*Theme Area(s): Transportation as a Service*

Unlike traditional personally-owned family vehicles, ride-sourced vehicles and taxicabs do not generally have permanently-installed child safety seats. This poses a serious concern for caregivers who want to protect their children during day-to-day travel and in unusual travel situations such as during vacations. This project will conduct an analysis of the current state of child passengers and child safety seat use in ride-sourced vehicles along with other more traditional sources of transit such as taxicabs.

**Project 01-006: [Implications of Truck Platoons for Roadside and Vehicle Safety Hardware](#)**

*Institution(s): TTI\*, VTTI*

*Award Round and Date: Initial Projects 3/16/2017*

*Theme Area(s): Automated Vehicles; Connected Vehicles*

Truck platooning involves automated lateral and longitudinal vehicle control while trucks move in tight formation with short following distances. It is unknown whether the existing roadside safety hardware is sufficient to resist a potential impact from a fleet of multiple trucks platooning at high speed. This project will identify and prioritize the critical Manual for Assessing Safety



Hardware (MASH) TL5 roadside safety device(s) for truck platooning impact assessment in order to understand the associated roadside and occupant risks and hazards.

**Project 01-007: [Preparing Work Zones for Automated And Connected Vehicles](#)**

*Institution(s): TTI\*, VTTI, SDSU*

*Award Round and Date: Initial Projects 3/16/2017*

*Theme Area(s): Automated Vehicles; Connected Vehicles*

This project will examine how transportation agencies, contractors, and other stakeholders can best plan, design, and implement work zones to accommodate and support connected and automated vehicle (CV/AV) operations. Results will be disseminated via journal article(s) as well as presentations at state and national meetings of transportation professionals and industry. A document will also be generated to provide transportation agencies and OEMs with a short synopsis of the current state of the art in thinking about CV/AV work zone considerations and potential solutions.

**Project 02-008: [Pavement Perspective on AV Safety through Optimizing Lateral Positioning Pattern](#)**

*Institution(s): TTI\*, VTTI*

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Automation, Connectivity*

Currently, an AV positions itself within a lane by keeping a fixed distance from the lane marker or other reference. From the pavement perspective, this channelized traffic will create deeper wheel path ruts which potentially can lead to an increased risk of vehicle hydroplaning and other safety problems. This project will evaluate channelized traffic from a pavements perspective and develop guidelines for reducing AV/CV hydroplaning potential through optimizing a lateral wheel positioning pattern and designing more rut resistant pavement surfaces.

**Project 02-009: [Vehicle Occupants and Driver Behavior: An Assessment of Vulnerable User Groups](#)**

*Institution(s): TTI\**

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Big Data Analytics*

The question of whether driver behavior differs based on vehicle occupancy—and more specifically, the characteristics (such as age and relationship) of the occupants—is an important safety question related to the Safe-D application areas of risk assessment, vulnerable users, and driver factors and interfaces, as well as the theme of big data analytics. This project seeks to better understand the impact of vehicle occupants in speeding driving behavior. The results will be used to recommend appropriate safety countermeasures.

**Project 02-010: [Safety Perceptions of Transportation Network Companies \(TNCs\) By The Blind And Visually Impaired \(BVI\)](#)**

*Institution(s): TTI\**

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Transportation as a Service*

Many among the blind and visually impaired (BVI) cannot drive, and access to safe and reliable transportation can be a significant challenge. Transportation Network Companies (TNCs) have emerged as a new mode of travel that has the potential to increase access to transportation for BVI individuals. This project will identify how the BVI community perceives the safety of TNCs relative to other travel modes, and how the BVI community utilizes TNCs for safe mobility.

**Project 02-014: Formalizing Human-Machine Communication in The Context of Autonomous Vehicles**

*Institution(s): TTI\*, VTTI*

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Automation, Connectivity*

In many driving situations (typically in crowded traffic conditions), tacit communication between drivers and pedestrians govern overall driving behavior, significantly enhancing driving safety. However, current AVs engage in decision making that is primarily driven by on-board or external sensory information, and do not explicitly consider communication with pedestrians. This project will incorporate formalized communications into decision making algorithms of an AV.

**Project 02-016: Older Drivers And Transportation Network Companies: Investigating Opportunities for Increased Safety and Improved Mobility**

*Institution(s): TTI\**

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Transportation as a Service*

For older populations, TNCs have the potential to provide enhanced mobility for a range of transportation needs. As it is well-documented that older drivers have a higher potential for crashes, there are significant potential safety benefits to using TNCs. This project will assess the potential of TNCs to enhance safety by decreasing the number of older drivers on the roadways while increasing their mobility options.

**Project 02-019: Identification of Railroad Requirements for The Future Automated And Connected Vehicle (AV/CV) Environment**

*Institution(s): TTI\**

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Automated Vehicles; Connected Vehicles; Big Data Analytics*

Despite the large number of direct intersections between the public highway and largely private rail systems, little of the current intelligent transportation systems AV/CV research is focused on how to incorporate the railroad system and its operations/required safety information effectively into future roadway AV/CV system planning. This project will examine how freight and passenger railroad operational and infrastructure needs can be best considered in the development of future AV/CV system architecture.



**Project 02-020: [Behavior-Based Predictive Safety Analytics – Pilot Study](#)**

*Institution(s): VTTI\*, SDSU*

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Big Data Analytics*

This project seeks to explore the possibility of using large sets of naturalistic crash and behavior data collected as part of commercial fleet and behavior change management programs (collecting tens of thousands of crashes annually) to improve our ability to predict safety outcomes for particular drivers.

**Project 02-026: [Sources and Mitigation of Bias in Big Data for Transportation Safety](#)**

*Institution(s): TTI\**

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Big Data Analytics*

Big data sources allow more detailed analysis of vehicle, transit, bicycle, and pedestrian trips than ever before. However, big data generally represents transactions rather than trips—inherently including a range of biases related to representation. This project seeks to identify the sources of bias in big data for transportation safety planning and the approaches to mitigating bias in big data for passenger vehicles, transit, bicycling, and pedestrians.

**Project 02-027: [Street Noise Relationship to Vulnerable Road User Safety](#)**

*Institution(s): TTI\*, VTTI*

*Award Round and Date: Spring 2017 Projects 4/28/2017*

*Theme Area(s): Big Data Analytics*

Street noise may be a valuable proxy for safety variables such as motorized vehicle speed, volumes, and proximity to bicyclists, which could result in improvements to facility design and crash modification factors to reduce bicycle crashes. However, no studies have evaluated the relationship to date. This project will develop a method to evaluate street noise and documented crash rates on roadways.

**Additional Research Activities**

Beyond the competitive research projects, the consortium also applied cash cost share sources to fund additional projects. In consultation with the Safe-D management team, TTI selected the following four research projects:

**Project TTI-01-01: Analysis of an Incentive-Based Smartphone App for Young Drivers**

*Institution(s): TTI\**

*Award Round and Date: Directed 2017 Projects 4/28/2017*

*Theme Area(s): Transportation as a Service*

TTI has developed an app that provides rewards to teens for not touching their phone while driving. This project will evaluate the effect of different levels of incentives (e.g. gift cards, school competitions) on overall mobile device use. A graduate student from Civil Engineering is performing geospatial analysis of app and device use.

### **Project TTI-01-02: Field Evaluation of CV/AV in a Smart Connected Corridor**

*Institution(s): TTI\**

*Award Round and Date: Directed 2017 Projects 4/28/2017*

*Theme Area(s): Connected Vehicles*

This project will identify needs, purchase, and install intelligent transportation and connected vehicle equipment on a roadway corridor in the College Station area. This corridor is expected to be used by future Safe-D projects.

### **Project TTI-01-03: Comparison of SHRP2 Naturalistic Driving Data to Geometric Design Speed Characteristics on Freeway Ramps**

*Institution(s): TTI\**

*Award Round and Date: Directed 2017 Projects 4/28/2017*

*Theme Area(s): Big Data Analytics*

This project utilizes data from the VTTI-led SHRP2 Naturalistic Driving Study. It will identify freeway ramps with specific geometric characteristics within the SHRP2 data set and examine driver speed and acceleration profiles in these locations.

### **Project TTI-01-04: Influences on Bicyclists and Motor Vehicles Operating Speed within a Corridor**

*Institution(s): TTI\**

*Award Round and Date: Directed 2017 Projects 4/28/2017*

*Theme Area(s): Big Data Analytics*

This project utilizes data from San Diego State's bicycle counters. It will explore fusing bicycle count data with crowd-sourced vehicle travel time data from the same location to discover challenges in merging these disparate data sources. The project will further examine vehicle speed when bicycles are present on a corridor.

TTI has also funded two graduate students to contribute to existing projects related to the SAFE-D themes.

1. Using Big Data to Assess Corridor Safety Performance at Approaches to Freeway Interchanges (PhD Student in Civil Engineering; NCHRP Project)
2. Truck Platooning Demonstration Project in Texas (M.S. Student in Mechanical Engineering; TxDOT project)

In addition, TTI has initiated a scoping project led by Dr. Johanna Zmud to better define the disruptors identified in the Safe-D application, recommend additional disruptive technologies to consider adopting into our theme area in the future, and develop a document to better articulate our themes and thrust areas for our stakeholder groups and research partners.

### **Completion of the Safe-D Data Management Plan**

During this reporting period, Safe-D developed and finalized the Safe-D Data Management Plan (DMP), a requirement for all UTC grants. The DMP describes the strategy that Safe-D will

adhere to for processing and archiving Digital Data Sets resulting from USDOT-funded scientific research in a repository that enables and allows for public access and sharing. To comply with from U.S. Department of Transportation (USDOT)-policy on dissemination and sharing of research results, Safe-D will utilize the VTTI Dataverse, a data repository maintained by VTTI based on the Dataverse platform. The VTTI Dataverse meets the criteria outlined in the Guidelines for Evaluating Repositories for Conformance with the DOT Public Access Plan. The VTTI Dataverse promotes an explicit mission of digital data archiving, as described on the Dataverse website (<http://www.dataverse.org>), and is listed by the USDOT as a Data Repository Conformant with the DOT Public Access Plan at <https://ntl.bts.gov/publicaccess/repositories.html>. The Safe-D DMP was approved on April 11, 2017, and will be reviewed yearly, at minimum, to ensure that the plan continues to address the UTC’s needs as the grant proceeds.

### **Educational Courses Taught and Students Supported**

Safe-D researchers are actively engaged in teaching efforts at each of the consortium universities and in supporting students through the conduct of research activities. While formal metrics will be reported under the annual Program Performance Indicators later this year, the following is a description of the preliminary metrics we have thus far gathered regarding courses taught and student support provided through the Safe-D program.

During this reporting period, researchers involved in Safe-D research projects reported teaching 15 graduate courses, reaching 204 students, and teaching 11 undergraduate courses, reaching 588 students. In addition to students involved in research projects through the Advancing Transportation Leadership and Safety (ATLAS)/Safe-D Summer Internship Program, research teams reported supporting 17 university-level students during this reporting period. As projects have just begun to get underway, we expect these numbers to increase as the grant continues, more research activities proceed, and more research projects are awarded. The breakdown of the students supported are presented in Table 1.

Table 1. Description of Students Supported under Safe-D Research Activities

<b>Academic Level</b>	<b>Total Number of Students Supported</b>	<b>Number of Underrepresented Students Identified</b>
<b>Undergraduate</b>	2	1
<b>Masters</b>	9	1
<b>PhD</b>	6	3

### ATLAS/Safe-D Summer Internship Program

Ongoing during this reporting period, TTI is hosting a summer undergraduate research opportunity internship program in partnership with the ATLAS Tier 1 Safety Center led by the University of Michigan. Safe-D is funding six students and ATLAS is funding three. Overall, 16 applications were received from seven Universities.



Interns were matched with mentors and research projects, including many led by Safe-D, to gain hands-on experience in transportation research (see Table 2).

Table 2. Summer Interns matched with Safe-D Researchers and/or Projects

Intern Name	School	Major	Mentor	Project Title
Ryan Augustine	University of Vermont	Civil Engineering	Kay Fitzpatrick	Non-motorized Crashes in Texas: Macro Level Analysis
Lizzie Clark	Virginia Tech	Civil Engineering	Marcus Brewer	Change of Vehicle Operating Speed in Presence of Bicyclists on Urban Arterial Roadways
Christian Estela	TAMU	Industrial/System Engineering	Tom Ferris	Countermeasures to Detect and Combat Inattention While Driving Partially Automated Systems
Quang Le	TAMU	Mechanical Engineering	Swaminathan Gopalswamy / Srinivas Saripalli	Visual and Audible Communication Between Self-Driving Cars and Pedestrians
Andrew Peretin	Virginia Tech	Mechanical Engineering	Adam Pike / Paul Carlson	Safety and Performance Criteria for Retroreflective Pavement Markers (part of NCHRP Project 05-21)
Rachel Sable	Virginia Tech	Industrial/System Engineering	Mike Manser / Laura Higgins	Driver Training for Automated Vehicle Technology

### VTTI Internship Hub

During this reporting period, VTTI has made great progress in developing plans for the VTTI Internship Hub. The Internship Hub is both a program and a physical structure which will be located adjacent to VTTI's test tracks and garages. The Internship Hub will provide advanced

training and practical hands-on experience to students in a variety of transportation-related areas. It is expected that Safe-D will bolster this initiative by funding interns who will participate in Safe-D research with graduate students and faculty across universities. Plans for the Internship Hub will continue to be developed during the next few reporting periods, with the hopes for implementation beginning in the 2018–2019 academic year.

## Dissemination of Results

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### Research Project Results

As all Safe-D projects were only recently awarded, no project has yet been completed or created products for dissemination. However, as Safe-D requires each project to have both an EWD and T2 component, products of each project have been identified and research teams are working diligently toward the dissemination of results, slated for future reporting periods, which will be dependent on the individual timelines of each project. As results are disseminated during the course of projects, they will be listed in the Products section of this report.

### Other Outreach Activities

#### Outreach to Intra-University Departments and Potential Partners

During this reporting period, a concerted effort was made to reach out to members of the University community, as well as public and private entities involved in transportation research, who were not aware of Safe-D.

Safe-D Director, Zac Doerzaph, and Program Manager, Leslie Harwood, gave multiple presentations to the members of the university community during this reporting period as well as to potential partners from government and industry. During VTTI's bi-annual meeting with members of the University research and academic communities, Ms. Harwood made the group aware of Safe-D's research, EWD, T2, leadership, and diversity programs. In addition, Dr. Doerzaph spoke at a bi-annual meeting of the National Surface Transportation Safety Center for Excellence (NSTSCE). NSTSCE was established at VTTI by the Federal Public Transportation Act of 2005 to develop and disseminate advanced transportation safety techniques and innovations in both rural and urban communities. During this meeting, Dr. Doerzaph gave an overview of the Safe-D program, focused on the research activities currently underway, and discussed potential collaboration opportunities with the stakeholders. Representatives from the Safe-D Leadership Team also conducted outreach at the Society of Automotive Engineers (SAE) 2017 Government/Industry Meeting in Washington, DC. A one-page overview of Safe-D and potential collaboration opportunities was widely distributed to industry and government entities, with the aim of identifying collaborators for stakeholders and to facilitate T2.

Safe-D Associate Director, Sahar Ghanipoor Machiani, reached out to the San Diego Association of Governments (SANDAG), San Diego's Regional Planning Agency, to introduce the Safe-D National UTC and discuss potential collaboration opportunities. Safe-D Associate Director, Sue Chrysler, also presented Safe-D information to technical staff, managers, and senior executives

from potential industry partners at TTI. These partners have expressed interest in engaging in Safe-D research activities and participating in the advisory board.

In addition, both VT and TAMU have teams which have been selected as competitors for the SAE-GM Autodrive Challenge. Dr. Chrysler has reached out to a contact within GM to discuss collaborative opportunities between the two university teams and resource sharing of GM contributions, including that which may be used for research projects, T2, and K-12 STEM activities.

### K-12 Outreach

In addition, the Safe-D leadership team conducted efforts to reach out to K-12 programs for the purpose of enhancing public understanding of and increasing interest in learning about transportation careers. On Thursday, March 30, 2017, Melisa Finley and Chiara Silvestri-Dobrovolny hosted a resource booth at the Texas A&M University STEM 4 Innovation Conference for K-12 Education. Over 100 educators from around the state of Texas attended “A Night at the Museum,” which included dinner, interactive activities, and resource booths from across the Texas A&M campus. The TTI booth included information about TTI and its educational outreach programs. TTI researchers promoted the new in-class curriculum on real-world applications of reflection and refraction being developed as part of the Safe-D National UTC. Educators also inquired about field trips to TTI and STEM/STEAM night activities. During the conference, TTI researchers handed out approximately 40 flyers about TTI’s educational outreach programs as well as many business cards.

In addition, TTI hosted students from two elementary schools in College Station, TX to teach them about transportation research and related careers. A total of 77 sixth grade students visited TTI headquarters. Groups of students rotated through five demonstration areas, learning from many TTI researchers involved in Safe-D research projects, including the following:

- Bikes are Vehicles Too! Safe and Smart Biking Skills (Michael Martin)
- Distracted Driving (Katie Womack)
- Transportation and the Environment (Beverly Storey)
- Up Close with Traffic Control Devices (Sue Chrysler)
- How Do Traffic Signals Work? (Srinivasa Sunkari)



On April 25, 2017, VTTI held the annual VTTI and VDOT School Day and Virginia’s Smart Road Open House. These two events reach thousands of students and community members in the Blacksburg, Virginia and surrounding New River Valley region each year. Individuals, families, groups, and students were invited to tour VTTI and the Virginia Smart Road facilities, and listen to presentations on VTTI, Safe-D, and other Center research and learn about how transportation safety research is conducted.



On Tuesday, June 6, 2017, Safe-D Program Manager, Leslie Harwood, presented Safe-D program activities to high school students at the Thomas Jefferson Symposium to Advance Research (tjSTAR), with an emphasis on the exciting careers available in transportation as well as opportunities available to students under the Safe-D EWD Program. tjSTAR is an annual, day-long symposium at Thomas Jefferson High School for Science and Technology, the Governor's School for Science and Technology in Northern Virginia, that offers the opportunity to share student research projects and learn about future research opportunities and potential careers. Students attended sessions led by Ms. Harwood where, after the presentation was made, they were able to discuss, both in a group setting and one-on-one, potential academic paths toward transportation-related careers and Safe-D student opportunities, such as the ATLAS/SAFE-D Summer Internship Program, VTTI Internship Hub, and other programs.

## Plans for the Next Reporting Period

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### **Safe-D Fall 2017 Collaborative Research Planning Workshop and Call for Proposals**

During the next reporting period, the Safe-D National UTC will hold the Fall 2017 Collaborative Research Planning Workshop, which will foster open meetings among researchers to discuss new ideas, including breakout sessions focused on particular research applications. Following this multi-day, electronically-facilitated workshop, research teams will be encouraged to submit their research ideas for award under the Fall 2017 Safe-D Call for Proposals. It is expected that awards will be made at the end of, or just following, the next reporting period.

### **Professional Development Seminar Series**

During the next reporting period, Safe-D will begin its formal professional development seminar series. Seminars will be held roughly once every 2 months, although they may be held more often for a series or to take advantage of visiting lecturers. The topics for the 2017–2018 academic year are:

- Guest lecturers (visiting scholars and researchers, special topics)
- UTC research results presentations
- Leadership skills
- How to write a technical paper
  - How to conduct a paper review (may include mock Transportation Research Board [TRB] reviews)
  - How to do a literature review
- Job interview preparation
  - Interview etiquette
  - Mock interviews
- Student presentations
  - Gain presentation experience
  - Share research with others
- Ethics

- How to write a proposal
  - Answer the “why?”

### **Outreach Activities Planned**

During the next reporting period, Safe-D will be participating in the Virginia Department of Transportation (VDOT) Northern Virginia District 13<sup>th</sup> annual Transportation Career Fair to be held in Northern Virginia. Last year, the career fair brought a record 1,500 area high school students and included numerous hands-on opportunities for students, including networking with employers, trying equipment, learning how to build a bridge and a demonstration on how concrete is made. Safe-D will be among approximately 100 engineering firms, organizations, agencies and contractors from across Virginia that encourage students to learn about careers in transportation-related fields, such as civil engineering, architecture, technology, construction, and environmental engineering.

In addition, as a highly-respected member of the faculty at Virginia Tech, Safe-D EWD Coordinator, Dr. Miguel Perez, has been asked to participate as a panelist in ExploreVT during the next reporting period. Virginia Tech will host academically curious rising juniors from historically underserved or underrepresented populations to participate in a residential academic summer enrichment program held from June 25–30, 2017 on Virginia Tech’s main campus in Blacksburg, Virginia. ExploreVT is a 5-day program that gives underrepresented students the opportunity to live in a Virginia Tech dorm, immerse themselves in a college environment, and learn from faculty from all eight of Virginia Tech’s colleges. Dr. Perez will be engaging the students in academic workshops and networking events in a professional setting.

Safe-D is also sponsoring the development of a K-12 school visit curriculum and kit on the topic of the Science of Retroreflectivity. TTI is leading this effort and has hired a fifth grade science teacher to work over the summer to improve existing demonstration materials. She will also be identifying state and Federal curriculum elements that are fulfilled by the demonstrations in the areas of engineering and optics. By the end of summer 2017, it is expected that new school visit materials will be produced and Safe-D will pilot test them locally in the 2017/18 school years.

## **Products**

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As mentioned, all Safe-D research projects were awarded during this reporting period and as such do not yet have resulting products. However, specific products have been identified for development and dissemination within each project’s T2 plan, a requirement of each research project.

In order to ensure that T2 plans for each project receive continued attention, each of the research teams is being contacted by the T2 Coordinator shortly after the project start date. The purpose of this initial communication is to establish a point of contact within the research team, clearly

lay out expectations, offer help and guidance, and encourage research teams to expand their activities in this area as much as possible.

## Publications, Conference Papers, and Presentations

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Nothing to report.

## Website(s) or Other Internet Sites

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### Safe-D Website

During this reporting period, the [Safe-D National UTC website](#) underwent considerable development and was completed per grant requirements. In order to keep up with current trends and follow proven methods that engage audiences without overwhelming them with information, Safe-D has drawn on the considerable experience of the consortium partners in developing the Safe-D website. As it will be a primary point for public information regarding Safe-D research projects and dissemination of results, the Safe-D website was developed to captivate its audience through a modern, minimalist approach to rapid information sharing. Safe-D plans to continue to adjust our external presence as new trends emerge.

### Safe-D Researcher Portal

In order to facilitate inter-consortium collaboration and access to Center-level resources across our geographically dispersed universities, the Safe-D Researcher Portal was developed and completed during this reporting period. Development of this site started from scratch in December 2016 using Microsoft Office 365 Sharepoint development tools, and the first development iteration was completed in March. This portal is the primary launch-point for Safe-D researchers and provides detailed information for access to everything they need, including:

- Center background information
- Descriptions of research themes and application areas
- Calls for proposals
- Guides to the Safe-D proposal process
- What to do after a project is awarded
- How to close out a Safe-D project
- Access to resources including webinars
- Student opportunities to support Safe-D educational and workforce development goals
- A directory of Safe-D research personnel

The researcher portal was made available to research teams after Initial Projects were awarded in late-March and continues to be updated as Safe-D evolves.

### Safe-D Dataverse Repository

As previously mentioned, the Safe-D completed its DMP during this reporting period. In addition, during this time, members of the Safe-D Leadership Team worked with the VTTI Center for Information Technology and Center for Data Reduction and Analysis Support to plan

for the additional development needed of the VTTI Dataverse to support Safe-D needs. As described, the Safe-D site on the VTTI Dataverse will house all of the digital data produced by Safe-D research projects during the course of the grant and will allow interested parties to download and use the publically-available data produced to continue to build on research results. A simple mock site was developed during this period, and the final site is expected to be finalized during one of the next two reporting periods, and prior to the completion of any Safe-D research projects which will use this resource for dissemination of their data.

## Technologies and Techniques

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Nothing to report.

## Inventions, Patent Applications, and/or Licenses

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Nothing to report.

## Other Products

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Nothing to report.

# Participants and Collaborating Organizations

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## Partners

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During this reporting period, Safe-D has worked to promote partnerships and collaborations with academic institutions, other nonprofits, industrial or commercial firms, state and local governments, school or school systems, and other organizations. While the Safe-D Stakeholder Advisory Board has not yet been identified, and thus there are no organizations to report in this section, members of the Safe-D Leadership Team have reached out to a number of potential partners at a program level. This includes the described Outreach to Intra-University Departments and Potential Partners. It is expected that the Stakeholder Advisory Board will be built and organization partnerships will be described beginning in the next reporting period.

Collaboration is a key part of the Safe-D program. Of the 28 competitive and directed research projects awarded during this reporting period, 11 are collaborative across university partners, with each partner leading at least one collaborative project. Safe-D continues to make collaborative research a priority when selecting projects for award and matching similar submissions so that researchers can build on the expertise and resources offered by each institution. In addition, as EWD and T2 components are required of each research project, projects which are not led or in collaboration with VTTI will still use the resources at VTTI to facilitate their plans through their close communication with the EWD and T2 Coordinators at VTTI. The Institutional Review Board (IRB) process for all Safe-D research projects is also being facilitated through the Virginia Tech IRB; therefore, collaboration with the internal VTTI IRB team has been necessary for all projects requiring IRB-approval.

In addition, as T2 is an integrated part of all Safe-D research projects, many researchers have already identified potential collaborators for research support. The following collaborations were reported by research teams during this reporting period:

- Project 01-004: Driver Training for Automated Vehicle Technology:  
Research team is collaborating with William Van Tassel with the American Automobile Association (AAA) to identify driver training protocols that might be used for automated vehicle training.
- Project 01-003: Data Mining to Improve Planning for Pedestrian and Bicyclist Safety:  
Research team has reached out to the city of San Diego, CA and SANDAG for possible collaboration opportunities.

It is expected that, during the next reporting period, additional contacts will be made with potential partners at a Center-level and for individual research projects. In particular, the researchers working on Project 02-020: Behavior-Based Predictive Safety Analytics – Pilot Study have reported their plans to reach out to key stakeholders in the industry in the next reporting period. SDSU also plans to have follow-up meetings with SANDAG and City advisory groups during the next reporting period to further discuss partnership opportunities and receive feedback on research needs which could be supported through the Safe-D research program.

## Impact

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### Impact on Transportation Safety

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Safe-D focuses on the Fixing America's Surface Transportation (FAST) Act priority area of "Promoting Safety." Safe-D believes that innovative research on emerging technology will advance the methods of evaluation and improvement of safety. For example, Project 01-003: Data Mining to Improve Planning for Pedestrian and Bicyclist Safety is currently exploring new data collection methods to improve safety planning for vulnerable road users. In addition, EWD components of research projects often produce materials which will be used directly in class discussions, thus improving the quality of teaching and learning by enhancing pedagogical materials, thus impacting the future of transportation safety. For example, SDSU Associate Director Dr. Machiani was recently introduced to a CV/AV-related paper through her work on Project 01-004: Driver Training for Automated Vehicle Technology. Dr. Machiani used the findings of this in a graduate course she teaches as homework/class discussion material and reported that this generated a lot of interest among students, one of whom is now seeking to start his master's thesis on a CV/AV related topic in Fall 2017 and will be seeking Safe-D support. Further, through this relationship researchers at SDSU are learning operational techniques and leadership skills required to maintain a transportation research center from two of the most successful institutes in the country.

## Impact on Other Disciplines

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Safe-D aims to make a broad impact even beyond the principal discipline of the program. Many Safe-D research projects are interdisciplinary, drawing on research teams with backgrounds in engineering, computer science, architecture and urban planning, and many other disciplines. This interdisciplinary nature of Safe-D research projects allows for the Safe-D program to impact and to stimulate entry into the transportation field from a broader array of disciplines. For example, Project 01-003: Data Mining to Improve Planning for Pedestrian and Bicyclist Safety employs one graduate student from Computer Science and one graduate student from City Planning who are directly working together. This collaborative, cross-discipline interaction of researchers working toward a single goal in improving transportation safety is likely to also make an impact on these students' respective fields of study.

## Impact on the Transportation Workforce Development

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Safe-D seeks to prioritize EWD by both leveraging existing programs at each consortium university and creating entirely new programs using grant funding. The impact that Safe-D will likely have on development of the transportation workforce will be on the transportation-related courses that Safe-D faculty teach, the products of research activities through their required EWD components, the students supported by the Safe-D program and their individual research projects, and Safe-D outreach to K-12 programs and promotion of transportation-related careers and STEM.

Through direct support for students, Safe-D research projects have a positive effect on the quality of teaching and learning opportunities provided and enhance the quality of education that students enrolled in transportation-related programs will receive. For example, programs that Safe-D has supported, including the ATLAS/Safe-D Summer Internship Program and development of the VTTI Internship Hub, are making a direct impact on the development of the transportation workforce through student involvement on Safe-D research projects which seek to meet the most pressing needs of public and private industry in preparation for students entering the transportation workforce. Programs such as these are preparing students to handle the challenges of our changing transportation system. In addition, SDSU offers the only transportation program in the San Diego region and most of local transportation workforce are SDSU graduates. By continuing to transfer the knowledge gained through Safe-D research activities to the classroom, the education that these students are receiving is building the best transportation workforce possible.

Funding through the UTC also allows graduate students the opportunity to participate in high-quality research activities which are often related to their theses or dissertations. As previously described, the research projects awarded are currently supporting 17 university-level students. Many of these students may not have had similar opportunities for funding and thus may not have been accepted into their academic programs without Safe-D support. In the case of SDSU, graduate assistantships in the Civil Engineering Department at SDSU are in the form of hourly



wages, leaving a gap in funding for graduate research work. Safe-D has provided SDSU research teams the opportunity to cover students' tuition/fees, which will result in better quality research activities and more interest in the transportation program.

In addition, to maximize the EWD impact of the UTC research outcomes, the inclusion of an education component into each new UTC project continues to be a cornerstone of Safe-D. Thus, to receive funding, a project must have an EWD plan that describes what new learning materials will be produced by the project and identifies which of the Safe-D programs, either existing or new, will be targeted for educational and workforce development. Research teams will be led by the Safe-D EWD Coordinator in this area, who will offer guidance to the teams in meeting their stated EWD goals and encouraging expanded activities in this area, when possible. To-date, Safe-D has awarded 22 competitive research projects, which will result in, at minimum, 22 learning modules for inclusion in coursework (at any level, including higher education, K-12, or government or industry trainings/short courses). As a result of implementation of these modules into coursework, Safe-D research projects will continually impact the development of the transportation workforce.

### Impact on Physical, Institutional, and Information Resources

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The USDOT grant which created the Safe-D National UTC has afforded consortium universities with great opportunities to make an impact on physical, institutional, and information resources that would otherwise be unsupported or under-supported. During this reporting period, TTI was able to purchase multiple computers for use by graduate students on Safe-D research projects, improving the facilities and resources at TTI in the long-term. In addition, the TTI-led project, Field Evaluation of CV/AV in a Smart Connected Corridor, seeks to identify needs, purchase, and install intelligent transportation and CV equipment on a roadway corridor in the College Station area. This corridor is expected to be used by future Safe-D projects. Without the creation of the Safe-D National UTC, this corridor was unlikely to have been developed and thus a lost resource to TTI and the transportation research entities which may also have been involved. VTTI also is continuing development of the VTTI Internship Hub, which, along with industry funding of specific research projects, will be strongly supported by Safe-D through the EWD program. Safe-D will be bolstering the Internship Hub initiative by funding interns which will participate in Safe-D research with graduate students and faculty across all consortium universities, with an expected impact of 15 undergraduates and 3 graduate students per year. Without the creation of Safe-D, it is unlikely the VTTI Internship Hub would be developed and this impact on university resources would not be realized.

SDSU has also reported that, due to the award of Safe-D, they have been able to enter into negotiations for a better-quality student and research lab for their Transportation group, which is expected to be instituted within the next year. In addition, through the funding available through the UTC grant, SDSU is planning to purchase a server to store project databases and run heavy computational programs. Without the funding afforded by the grant, these improved resources would not be available to SDSU.

## Impact on Technology Transfer (T2)

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The efforts of the Safe-D T2 program are designed to make UTC research results available to potential users in a form that can be implemented, utilized, commercialized, or otherwise applied with minimal effort. Each research project is required to submit a T2 plan, which describes the materials that will be produced and identifies programs, either existing or new, that will be targeted for T2. With the assistance of the Safe-D T2 Coordinator, Dr. Mike Mollenhauer, each researcher conducts these activities in parallel with their research project, engaging potential stakeholders and working toward implementation of research results. Some examples of the T2 activities that Safe-D research projects will include are:

- T2 Technical briefs and videos
- Workshops and conferences
- Journals and other publications
- T2 promotion events
- Web presence and social networking
- Short courses

By focusing each research activity on implementation of results and dissemination through targeted T2 activities, Safe-D is likely to have a major impact on the future of our transportation system.

## Impact on Society Beyond Science and Technology

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While the primary goal of Safe-D is proactively promoting transportation safety, with the vision of a nation with a systematically safe transportation system, it is expected that the activities conducted under all Safe-D programs, including research projects, will have an impact on society beyond our primary focus area. Goodwill activities such as the VTTI and VDOT School Day and Virginia's Smart Road Open House seek to communicate our impact on transportation safety to the general community and individuals' everyday lives. In addition, the broad media coverage that Safe-D has and is likely to continue to receive is increasing the layman's knowledge of transportation and informing the world of impending changes to the transportation system through disruptive technologies. Safe-D is also assisting in developing the transportation workforce, thereby contributing to the national economy by positioning graduating students to easily transition to employment in public and private sectors. Through these and other program activities, Safe-D is making a broad impact, not only on the primary focus of the UTC, but also on society as a whole.

## Changes/Problems

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### Changes in Approach

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During this reporting period, the Safe-D Leadership Team decided to slightly alter the Center's acronym from the name identified in the grant application ("SafeD" to "Safe-D"). The Safe-D

Grant Manager, Amy Stearns, was contacted and informed of the change. The request was approved and the name was officially changed in various places, such as the UTC website and internal mailing lists.

### Actual/Anticipated Problems/Delays

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Nothing to report.

### Changes Affecting Expenditures

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Nothing to report.

### Changes in Study Protocols

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Nothing to report.

### Changes in Performance Site Location

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Nothing to report.

## Additional Information Regarding Products and Impacts

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### Outputs

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As research projects are just beginning to get underway, the majority of additional information regarding products and impacts will be reported in the coming reporting periods. However, the TTI-led project, Teens in Driver Seat Data Analysis, reports that the research team has initiated work on a TRB paper (due August 1, 2017) for the Annual TRB Meeting in 2018, as well as a workshop submittal for the annual Lifesavers Conference in April 2018. In addition, the Safe-D Project 01-005: Factors Surrounding Child Seat Usage in Ride-Share Services has been selected for the UTC Spotlight Newsletter to be released in February 2017.

### Outcomes

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Nothing to report.

### Impacts

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Nothing to report.

## Special Reporting Requirements

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N/A