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Preview of Award 2054997 - Annual Project Report

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Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	2054997
Project Title:	Preparing Students for Technical Careers in Autonomous Technologies for Commercial Trucks and Off-Highway Vehicles
PD/PI Name:	Carl W Borleis, Principal Investigator Chris J Hadfield, Co-Principal Investigator Shannon D Mohn, Co-Principal Investigator
Recipient Organization:	Dakota County Technical College
Project/Grant Period:	04/15/2021 - 03/31/2023
Reporting Period:	04/15/2021 - 03/31/2022
Submitting Official (if other than PD\PI):	N/A
Submission Date:	N/A
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	N/A

Accomplishments

* What are the major goals of the project?

Goal 1. Develop awareness of career opportunities and advancements in ISA-TOPE technology to a diverse array of K-12 students, transitional workers, and veterans.

Goal 2. Academically strengthen Truck Driving certificate programs and Diesel Technician degree programs, in Minnesota and beyond, to meet employers' growing need for TODOs, especially those skilled and knowledgeable about ISA-TOPE technology with a focus on repeatability and sustainability.

Goal 3. Provide leading-edge, hands-on, real-world ISA-TOPE technology to enhance educational and outreach activities.

* What was accomplished under these goals and objectives (you must provide information for at least one of the 4 categories below)?

Major Activities:

(#1) **Conduct outreach** - Waiting on building and delivery of training equipment.

(#2) **Create Professional Development (PD) Opportunities** - Conducted one PD session during Minnesota Teachers of Transportation and Industrial Areas (MTTIA) Annual Conference. Additional training sessions were not conducted due to a lack of scheduling and communication from the Diesel Training Liaison at MTTIA to CoPI Mohn. We have assessed the reasons for the lack of training during the most recent MTTIA conference, and are planning to provide the NSF-funded training at a time outside, but just prior to the MTTIA conference schedule. We are also rethinking our scholarship process and will work with NSF to determine next steps if a change in direction is needed.

(#3) **Curate/Create OER** - Have curated curriculum from multiple resources including US Department of Labor Skills Commons, but most needs to be created from OEM Service Information; while the curriculum will be usable for multiple vehicle models, much of the information such as pictures and schematics is individual unit specific, and we are still waiting on the building and delivery of training equipment or creation of specific serial/VIN data in order to access the needed unit-specific details.

(#4) **Secure New Equipment/Tools/Trainers** - All equipment has been ordered, but awaiting building and delivery. Working with industry partners to acquire various tools and trainers.

Specific Objectives:

Objective 2b. Provide ISA-TOPE focused PD to accredited institutions' faculty across the state to prepare Diesel Technicians to repair and service ISA-TOPE - Conducted one PD session during Minnesota Teachers of Transportation and Industrial Areas Annual Conference.

Objective 2c. Create industry-supported and conducted ISA-TOPE workshops - Training mentioned for Objective 2b was conducted by a representative of an industry-leading Original Equipment Manufacturer.

Objective 3a. Strengthen existing collaborations with ISA-TOPE industry partners - We have increased connection with both Caterpillar and Freightliner; These connections have helped us obtain access to Service Information, educational resources, and other related tools and equipment.

Objective 3b. Develop new ISA-TOPE industry partners - During an NSF-funded trip to the Technician Maintenance Council's Fall Meeting, connections were made with Bendix and Texa. Both of these companies offer technology, components, and resources for semi-autonomous vehicles. Both have offered to provide training and tools related to the ISA-TOPE equipment being acquired.

Objective 3d. Acquire minimum examples of ISA-TOPE technology available for any outreach, PD, or educational activity - All of the listed equipment has been ordered; global supply chain issues have delayed the building and delivery of these items. The current build dates for the various items are currently scheduled for spring 2022, but industry news of production schedules for many manufacturers is not favorable toward a high level of certainty of that build date. Many of our goals and objectives rely on having access to the equipment and technology that has been ordered.

Significant Results:	• Created road map for curriculum development
	• Identified needed resources
	• Gained access to Service Information from equipment manufacturers
	• Employer partners are on board
	• Team has been solidified
	• Some OER has been developed but is incomplete at this time due to delays in acquiring the needed technology
	• Technology & Maintenance Council Conference achieved many industry connections including Bendix, Texa, UPS, Minnesota specific connections with Ryder
	• Technology & Maintenance Conference was connected to several technical training resources through inclusion in an Educational Taskforce and the Automated Vehicle Study Group
	• Got an opportunity to tour the Dailmer Truck North America education resources training board manufacturing, research, battery, and electronics manufacturing facility and think about how it would connect to the ISA-TOPE project in the future.

Key outcomes or Other achievements:	CoPI Hadfiled was able to meet with both President Biden and US Secretary for the Dept of Education Miguel Cardona. CoPI Hadfield was able to speak briefly with President Biden, and in more detail with Secretary Cardona about what Minnesota is doing related to Career and Technical Education in the state, and future meetings with Secretary Cardona are being scheduled soon.
	Conducted meetings and listening events for faculty, along with personal interaction between CoPI Hadfield and individual faculty regarding the roll-out of the project to better ensure we are able to meet the needs of the various programs.

* What opportunities for training and professional development has the project provided?

One four hour training session from a truck manufacturer related to electronics, and new features including radar, LIDAR, and other autonomous technologies.

* Have the results been disseminated to communities of interest? If so, please provide details.

Created one-page flyer to communicate the purpose and existence of the program (see file submission).

Information shared at the conference was proprietary in nature and is not something that can currently be shared among the general public. Educational materials being created will include much of the information shared in the session while avoiding copyright issues.

* What do you plan to do during the next reporting period to accomplish the goals?

Actually acquire ISA-TOPE technology from manufacturers; complete curriculum; conduct Professional Development sessions; disseminate curriculum; create outreach resources. Given the delays in getting our technology from the manufacturers, we will be strongly considering asking for a 1-year extension.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
ISA-TOPE One PagerV2.pdf	A one-page flyer describing the existence and purpose of the grant project.	Carl Borleis	01/07/2022

Products

Books

Book Chapters

Inventions

Journals or Juried Conference Papers
View all journal publications currently available in the [NSF Public Access Repository](#) for this award.

The results in the NSF Public Access Repository will include a comprehensive listing of all journal publications recorded to date that are associated with this award.

Licenses

Other Conference Presentations / Papers

Other Products
Audio or Video Products.

90 second video created for ATE Connects which can/has been used to share a brief synopsis of the ISA-TOPE project.

Other Publications

Patent Applications

Technologies or Techniques

Thesis/Dissertations

Websites or Other Internet Sites
ISA-TOPE Informational Page
https://www.minntran.org/isa-tope/

Landing page for ISA-TOPE information and dissemination; this is a living document that will continue to be updated as the project progresses.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
ISA-TOPE MTTIA Scholarship Flyer.pdf	Flyer created showing opportunity for scholarship toward professional development conference registration.	Carl Borleis	02/03/2022
ISA-TOPE One Page Info Sheet.pdf	A one-page flyer created to give a brief description of the ISA-TOPE project	Carl Borleis	02/03/2022
ISA-TOPE Logo.pdf	Logo for ISA-TOPE project with name as â nucleusâ and six â electronsâ representing Technicians (wrench), Radar/LIDAR (oscillating beam), Off-Highway Equipment (bulldozer), Technology (computer), On-Highway Equipment (Truck), and Operation/Driving (steering wheel)	Carl Borleis	02/15/2022

Filename	Description	Uploaded By	Uploaded On
ISA TOPE Yr 1 Eval Report Final for PI 3-8-22.pdf	Evaluators' Report by Drs. Wijenaike and Mikolaski including Executive Summary	Carl Borleis	03/08/2022

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Borleis, Carl	PD/PI	2
Hadfield, Chris	Co PD/PI	1
Mohn, Shannon	Co PD/PI	1
Brownlee, Forrest	Community College Faculty	2

Full details of individuals who have worked on the project:

Carl W Borleis
Email: carl.borleis@dctc.edu
Most Senior Project Role: PD/PI
Nearest Person Month Worked: 2

Contribution to the Project: Oversight of project - worked on purchasing ISA-TOPE technology, managing budget, coordinated curriculum development; TMC training attendance coordination.

Funding Support: NSF ISA-TOPE grant

Change in active other support: No

International Collaboration: No
International Travel: No

Chris J Hadfield
Email: chris.hadfield@dctc.edu
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 1

Contribution to the Project: Assisted with curriculum creation, attended planning meetings, provide mentorship, suggestions on best practices, and has helped make many meaningful connections with a wide variety of stakeholders related to the advancement of the ISA-TOPE grant

Funding Support: NSF ISA-TOPE grant

Change in active other support: No

International Collaboration: No
International Travel: No

Shannon D Mohn
Email: shannon.mohn@minnesota.edu
Most Senior Project Role: Co PD/PI
Nearest Person Month Worked: 1

Contribution to the Project: Creation of educational resources, assist in MTTIA Conference training, attended various meetings, attended DTNA location in Hibbing to assess ADAS trainer offerings.

Funding Support: NSF ISA-TOPE grant

Change in active other support: No

International Collaboration: No
International Travel: No

Forrest Brownlee
Email: forrestbrownlee@hibbing.edu
Most Senior Project Role: Community College Faculty
Nearest Person Month Worked: 2

Contribution to the Project: Curriculum writing and consulting for project; connection to Texa and a borrowed scan tool likely to be donated to the project; connection to Daimler training board manufacture for a tour; local Ziegler Caterpillar dealership partnership; helped develop the KSA map; and allowing Hibbing Community College to be one of our pilot test sites for the curriculum and equipment once developed; and helps to address critique during our (pre-award) review of not having a diesel or truck teacher on the team.

Funding Support: TCOE funds made available by grant covering a portion of PI Borleis' pay.

International Collaboration: No
International Travel: No

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
I-State	Industrial or Commercial Firms	Rosemount, MN
Ziegler Cat	Industrial or Commercial Firms	Hibbing, MN

Full details of organizations that have been involved as partners:

I-State

Organization Type: Industrial or Commercial Firms
Organization Location: Rosemount, MN

Partner's Contribution to the Project:
In-Kind Support

More Detail on Partner and Contribution: Providing Service Information, and have stated they will provide training, and additional resources for training during MTTIA

Ziegler Cat

Organization Type: Industrial or Commercial Firms
Organization Location: Hibbing, MN

Partner's Contribution to the Project:
In-Kind Support

More Detail on Partner and Contribution: Providing Service Information, and have stated they will provide training, and additional resources for training during MTTIA

Were other collaborators or contacts involved? If so, please provide details.
Nothing to report

Impacts

What is the impact on the development of the principal discipline(s) of the project?

1.) PI Borleis and Co-PI Hadfield met with Paul Soar from Florida State College in Jacksonville (DUE 2000618). Discussed possible synergies between projects. Paul was asked and has agreed to be part of a newly created Advisory Committee for ISA-TOPE curriculum development.

2.) Due to conversations that occurred at the TCOE, visions were created, and discussions were conducted with the automotive sector that furthered work in ADAS technology including the creation and submission of another NSF grant for ADAS in automotive (Educating Autonomous Vehicle Technicians submitted by Riverland Community College, Albert Lea, MN).

3.) PI Borleis and Co-PI Hadfield met with PI Smith and Co-PI Holmes from Wallace State Community College in Alabama (DUE 2100297). The two projects were discussed and resources were shared that will help them in their project for virtual training options and helping more women into the Diesel Technician field. ISA-TOPE staff connected Wallace State staff with Women in Trucking CEO Ellen Voie and Techforce, along with sharing the Wrench (Automotive) and Truck Maintenance VR offerings from STEAM. They were unfamiliar with either program/system. Good connections were made, with plans to connect in person at the Hi-Tec and/or PI Conferences this year.

4) Co-PI Hadfield has become the co-chair of the Minnesota Department of Transportation's Connected and Autonomous Vehicles Workforce Development Committee. In this committee, the ISA-TOPE project outcomes are connected to various resources and connections across the state, and help us gain perspective because of the variety of disciplines and others that are able to give input.

5.) PI Borleis has worked with Co-PI Mohn over the last year, along with Co-PI Mohn's involvment with cohort 9 of Mentor Connect, to help Co-PI Mohn to create and submit a New to ATE grant submission in the area of electric vehicle drive technologies and the creation of an industry-recognized certificate project (Amping Up Today's Electric Drive Automotive Education - AMPED Technology Certification: Advanced Modules in Powered Electric Drive Technology Certification).

6.) Co-PI Hadfield is a Mentor Connect Fellow providing subject matter expertise in the area of automotive technologies for PIs submitting ATE grants related to those technologies.

What is the impact on other disciplines?

1.) Due to conversations that occurred at the TCOE. visions were created, and discussions were conducted with the automotive sector that furthered work in electric drive technology including the creation and submission of two other NSF grant for electric drive technology in automotive (Amping Up Today's Electric Drive Automotive Education - AMPED Technology Certification: Advanced Modules in Powered Electric Drive Technology Certification submitted by Minnesota State Community and Technical College, Moorhead, MN; and a proposal submitted by Hudson Valley Community College, Troy, NY.)

2.) US President Joe Biden visited Dakota County Technical College (DCTC) and met with CoPI Hadfield on Nov 30, 2021.

Here is the link sent out through TCOE channels: https://www.minntran.org/transportation-center-director-speaks-with-president-joe-biden-during-visit-to-dctc/?hilite=biden

These are the events that led up to the visit:
- Spring 2020 the AED (Association of Equipment Distributors) had scheduled a tele-town hall with US Congressional Representative Angie Craig (District 2 of Minnesota - SE part of the twin cities urban and rural areas). The town hall was a chance for employers in the diesel equipment sector to talk with Rep. Craig about their issues, which were mainly workforce development. CoPI Hadfield was invited to be on the call and was able to meet Rep Craig and talk about the work the TCOE is doing. Keep in mind that this was spring 2020 and we were just starting to write the ISA-TOPE grant.

- Summer 2020 CoPI Hadfield met with Rep. Craig again (on Zoom) and talked about the TCOE, DCTC, and what the State of MN is doing for CTE.

- Summer 2020 CoPI Hadfield arranged a meeting with Rep. Craig to meet the CTE staff at the Minnesota State system office (state leadership)

- Fall 2020 Rep. Craig helped write an article for the AED's supported magazine http://www.cedmag.com/magazine-archives/2020-july/one-size-fits-some-when-career-and-technical-education-makes-sense

- Spring 2021 Rep. Craig, CoPI Hadfield, and the DCTC leadership had a Zoom call about the new CDL Academy and the NSF grant, and gaining support from Wash DC in multiple manners.

-Spring 2021 PI Borleis, along with other members of the Minnesota Trucking Association, met with Rep. Craig to discuss infrastructure funding and workforce development issues during a "Call on Washington" event.

- Summer 2021 Rep. Craig officially visited the DCTC campus and was able to spend time with CoPI Hadfiled and PI Borleis in the TCOE career exploration trailer, talking about inspiring students and collaboration challenges with industry/education (part of the congressional exchange visit) https://www.minntran.org/american-congressional-exchange-visit/?hilite=representative+craig

- November 2021, Rep. Craig arranged the visit to DCTC and the meeting with CoPI Hadfield. Present at the meeting and in some discussion were MN Governor Tim Walz, MN Senator Amy Klobuchar, MN Senator Tina Smith, and US Secretary for the Dept of Education Miguel Cardona. While meeting the President was memorable, the most valuable conversation occurred with with Secretary Cardona - and follow up from his office and additional meetings are being scheduled.

What is the impact on the development of human resources?
Nothing to report.

What was the impact on teaching and educational experiences?

Although we are still early in the stages of the grant due to the delay in getting the needed technology, we have increased discussion and "chatter" on the subject and have started to get more buy-in from instructors that may have been on the fringe of supporting the project and being part of it prior to its inception.

What is the impact on physical resources that form infrastructure?

Equipment for the grant is being purchased new. This provides for manufacturing jobs, and use of vehicle will contribute to road use funds to build and maintain highways across the state.

What is the impact on institutional resources that form infrastructure?
Nothing to report.

What is the impact on information resources that form infrastructure?
Nothing to report.

What is the impact on technology transfer?
Nothing to report.

What is the impact on society beyond science and technology?

Specific in Minnesota, we have had an impact on a handful of employers to be able to engage with them on autonomous technology and the academic realm. One example is an Original Manufacturer is willing to donate multiple training engines to the TCOE. Another example is the connection made with the Get Ahead program that is part of the Daimler Group, and through our connections are looking to modify how their autonomous technology is used by and available to educators.

What percentage of the award's budget was spent in a foreign country?
Nothing to report.

Changes/Problems

Changes in approach and reason for change

Global supply chain issues have caused unexpected delays in the building and delivery of the purchased ISA-TOPE technology, and have led to inflationary cost increases to the equipment. Much of the project relies on having the actual hands-on technology physically in our possession in order to take needed photos and video for curriculum creation and outreach materials. Price increases between proposal submission and award led to delays in ordering the equipment. Supply chain issues have led to addtional delays, and the potential for added costs increases required by the vendor after the vehicle has been ordered under state contract. This issue was negotiated and avoided and cost increases or cancellation of contracts (causing a restart to the order/purchase/build process). Current build or delivery dates are currently scheduled on or before May, 2022.

Curriculum and outreach materials rely on the ISA-TOPE technology to in our possession in order to take the needed pictures and videos related to many aspects of our task list and timeline. The essence and core of the curriculum is being created to the extent that it can be without the needed resources from the technology, and available media will be included in the curriculum once available.

Actual or Anticipated problems or delays and actions or plans to resolve them

This project has had a number of challenges, but also some notable successes. Almost all of the challenges faced during this project relate to the slow nature of the supply chain given current economic and pandemic related considerations. Our ability to create outreach, professional development materials, and curriculum, and our ability to schedule school visits and the loaning of ISA-TOPE technology is either hindered or completely blocked from occurring because of these delays and associated rising prices for the technology. That being said, we have continued to persevere, adapt, and innovate. These approaches have led to some successes and even improvements to our project. Following are three examples that showcase these three approaches, along with related successes, that have come to define our first year of the project.

Perseverance - Due to purchasing and supply chain delays (see "Adaptation" section), outreach events, outreach materials, and curriculum development cannot be finalized as we need the actual technology in order to include needed pictures and other "live" resources into our curriculum or to schedule outreach events and create outreach materials. While missing these critical resources, we have been able to work with suppliers to obtain information that would not normally be available to us until delivery of the equipment, and have been able to use this material to draft a Unit Outline, a Knowledge/Skills/Abilities (KSA) Map, and have used pictures related to ADAS technology from the automotive sector as "place-holders" to continue to develop the curriculum to the extent able by the situation.

Adaptation – As soon as we received the ISA-TOPE award, we began the process of purchasing the needed equipment. Almost immediately we realized that prices had increased since the previous calendar year and we would not be able to remain in budget and be able to purchase the equipment we had originally specified. We adapted by looking at different options for the Semi-Tractor as it was the most expensive item on our list. This delayed our purchasing process as we had to do additional research into other options. We settled on a slightly smaller vehicle, but one with 4 doors and seating capacity for at least 5 individuals. This allows us to accommodate more people safely and legally than our original design when giving demonstrations of the ISA-TOPE technology. This new selection actually has become a more useful and beneficial design change, and at a slightly cheaper price point that is within budget.

Innovation – In conducting our first Minnesota Teachers of Transportation and Industrial Areas (MTTIA) training sessions for ISA-TOPE, two issues arose. We were not able to schedule as many sessions as we had originally been promised, and only 1 out of the 40 scholarships for the event were utilized. Based on feedback from attendees of the event, we have changed our plans to conduct training at the next MTTIA event, not as part of MTTIA, but for the two days immediately preceding it

utilizing the same venue. Instead of offering scholarships, we will use the remaining funds to support the participants by providing for food and lodging for those that attend the training.

That one awarded scholarship, however, led to a very valuable asset to our project. The sole scholarship applicant was Forrest Brownlee (Hibbing Community College). After receiving the scholarship and attending our one training session, he became more interested and invested in ISA-TOPE. Forrest is doing curriculum writing and consulting for the project. He also attended the TMC conference when Co-PIs Mohn and Hadfield were unable to attend which led to a connection to Texa and a borrowed scan tool likely to be donated to the project. Forrest was also able to connect us to the Daimler training board manufacture for a tour, is having his local Ziegler Caterpillar dealership partner with this project, helped develop the KSA map, and Hibbing Comm College is now going to be one of our pilot test sites for the curriculum and equipment once developed. Plus, one of the critiques during our (pre-award) review was that we didn't have a diesel or truck teacher on the team. Now we do! In addition, Forrest and his dean are likely going to go into Mentor Connect for a fall '23 NSF "New to ATE" submission. Their college is going through a merger this year, so they want to wait one cycle to engage in the process given the work required to finalize the merger.

Perseverance, adaptation, and innovation will continue to describe much of what we will have to do on this project, but these three approaches bring success to life, this project, and the achievement of our project goals.

Changes that have a significant impact on expenditures

Participation our our scholarship program was underutilized, and there were significant challenges in getting the training coordinated through MTTIA's updated protocols. In discussions with faculty, it was determined that a different approach was needed. Our next round of professional development will be conducted on days previous to, but consecutive with the MTTIA schedule. Participant support will transition from scholarship to paying for added travel expenses related to the additional days.

Changes from face-to-face conference to online formats has resulted in unused funds. These funds will be utilized for other conferences, especially if an extension is requested as is currently expected.

Significant changes in use or care of human subjects
Nothing to report.

Significant changes in use or care of vertebrate animals
Nothing to report.

Significant changes in use or care of biohazards
Nothing to report.

Change in primary performance site location
Nothing to report.

Special Requirements

Responses to any special reporting requirements specified in the award terms and conditions, as well as any award specific reporting requirements.
Nothing to report.