



Exhibit D

Research Project Requirement Template

Increasing Understanding of Climate Emergencies and Enhancing Safety of Rural and Tribal Areas using Wireless Smart Sensors and Human-Environment-Data Interfaces using Augmented Reality (AR)

Recipient/Grant (Contract) Number: 69A3552348306 (CY1-UNM-01)

Center Name: Southern Plains Transportation Center (SPTC)

Research Priority: Improving the Durability and Extending the Life of Transportation

Principal Investigator(s): Fernando Moreu, University of New Mexico

Project Partners: University of New Mexico, High Water Mark LLC, The New Mexico Consortium, and Prospect Solutions LLC

Research Project Funding: \$80,000 (Federal) and \$80,000 (Match)

Proposed Start and End Date: 10/1/2023 to 09/30/2024

Project Description: This project aims to develop an interface between users and data in the context of low-cost deployment of sensors that can be tested to collect both rain and flooding during significant post-wildfire flooding events. The system will be wireless and validated with a local company in New Mexico, High Water Mark (HWM) LLC, with expertise in flooding. The support of Prospect Solutions, another participating company, will enable the research team to develop a transportation-directed tool that can be used for other aspects critical to durability. This project proposes using Low-cost Efficient Wireless Intelligent Sensors (LEWIS) that can be moved and installed at very low cost, measuring both rain and flooding levels (elevation). Real-time data from such sensors can inform the population about the flooding with 10-20 minutes' notice. The LEWIS are connected to the internet with hotspots and their design and installation are incremental so they can be changed by the owners. The first step will be to design and demonstrate a rain/flooding data interface system using simulated rainfall and flooding using indoor facilities at UNM. The second step will be located outdoors near a creek in the mountains to validate the power independence of such a system and to obtain field data from a rain and/or flooding event. The third step is to create a simulation of the sensor-AR interface to collect/identify thresholds of emergencies from the experts (HWM LLC and Prospect Solutions) and subsequently from the community in a workshop, involving a demonstration at the Ohkay Owingeh Casino.

US DOT Priorities: This project investigates the relationship between "Climate and Sustainability" by studying the effects of climate change in New Mexico specifically relative to wildfires and communication challenges. It also addresses "Economic Strength and Global Competitiveness" through the development of innovative technologies and tools to assist local communities to be better prepared for fire and post-wildfire flooding. The research team expects to patent the developed technologies/tools. Finally, this transformative research is expected to have a significant impact on safety, by protecting rural and tribal communities by working together with the emergency responders. The developed sensors and their capabilities can be used to train communities and to make data-driven decisions such as evacuation due to rainfall, flooding, and wildfire. The use of Augmented Reality and its interaction with data collected by the sensors is considered a breakthrough and transformative advancement.



Outputs: The outputs of this one-year project include the following: (1) New AR-LEWIS interface to relate emergencies with data and data-driven decisions. Simulation of flooding using this interface (i.e., AR and LEWIS data) will be a new human-centered visualization tool; (2) Updated hardware and software for sensor durability in extreme weather events, involving new internet connection design and outdoor testing to ensure long-term sustainability; (3) Collected input of the Pueblo members on this interface and recommendations on using augmented reality as a visualization tool; (4) A workshop involving demonstration of the developed AR; (5) Invention and patent disclosure; and (6) Peer-reviewed papers and presentations.

Outcomes/Impacts: The remote sensing system with AR-LEWIS interface is expected to have major impacts in rural, tribal, low-income, and underserved communities. This system can be used to provide flood and wildfire warnings to communities efficiently and cost-effectively. Also, the developed AR platform can be used to train communities to make informed decisions during extreme events. Such data-driven decisions will save lives and make the community safer.

Final Research Report: