Florida Department of Transportation Research

Long Distance Wireless Radio Frequency Link for the ITS Statewide Network

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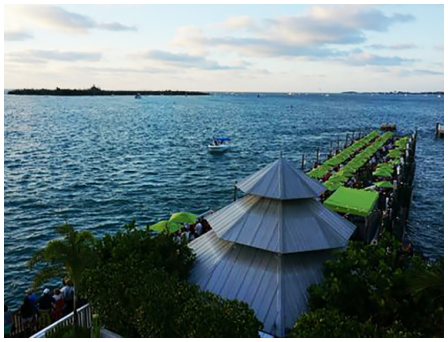
Current Situation

When we make a telephone call or send a text message, we expect an instant connection. This is made possible by a communications system that finds the fastest route between caller and recipient. The many pathways in the system also provide redundancy so that if part of the system is disabled, there are still many ways for the call to get through. As Florida's Intelligent Transportation System (ITS) becomes increasingly sophisticated with sensors that collect data and send it to traffic management centers for real-time evaluation and response, the ability to connect becomes more critical. In the Florida Panhandle in the northern part of the state and the Florida Keys to the south, the dedicated communications system of the Florida Department of Transportation (FDOT) operates over a single communications line. Therefore, there is no system redundancy or alternative path in these areas, which are often vulnerable to severe weather and communications disruptions.



Looking north from Key West. Destin is 500 miles away. The land in the distance is Wisteria Key (left) and Fleming Key (right).

Research Objectives

University of North Florida researchers designed, built, and tested a wireless communications link that could operate between the Keys and the Panhandle to provide an alternative communications path for the FDOT ITS.

Project Activities

Generally, wireless signals travel in a straight line, and while on a map, Key West and Destin can be connected by a straight line over the Gulf of Mexico, in reality, because of the earth's curvature, a true straight line between the two cities passes through many miles of water. The researchers reviewed the literature to determine whether a process called refraction would allow a signal over the Gulf to travel above the water, following the earth's curvature over the 500 miles between the two points at either end of the state. Conceptually, this is possible, but the first task was to develop the equipment that would produce the appropriate signal.

The researchers designed two main project apparatuses: a microwave transmitter and a receiver. Each one was equipped with a solar power unit, a computer, and a modem. Custom equipment – filters and oscillators – were designed and constructed to provide the very stable reference frequencies required. The modems allow both apparatuses to be controlled remotely from the researchers' facilities at the University of North Florida in Jacksonville. Thus, they could remotely initiate transmission in Key West and reception at Destin. Antenna positions and other functions can also be controlled remotely.

The project concluded with the successful testing of the transmission and receptions systems. The original scope of the project included a final stage of testing in the intended locations at Key West and Destin; however, due to project delays, temporary university travel restrictions, and equipment scheduling issues, FDOT has delayed final testing to a future project.

Project Benefits

This project successfully demonstrated the design and construction of equipment for wireless communications across the Gulf of Mexico. If full-scale testing is successful, a vital link in the FDOT data communications system will be established.

For more information, please see www.fdot.gov/research/.