Australian Government

Department of Defence
Science and Technology

distant reciever

High capacity formed beam

Array control and feedback

Distributed elements cooperatively form an array

Distributed elements cooperatively form an array

Distributed transmit beamforming

Expanding the capacity and range of tactical communications.

Military tactical units are increasingly reliant on wireless networks to provide commanders with high quality information for decision-making and to accelerate command and control. The continued deployment of network-based tactical applications is driving the demand for higher data rates. On the other hand, tactical units are constrained in their available space, weight and power and are often deployed over large geographic distances. Consequently these units can only establish low data rate communications between themselves and remote headquarter elements with links which are readily over-utilised.

Distributed transmit beamforming is an area of research that aims to enhance wireless network performance through cooperation of multiple radios. In this approach the radios simultaneously transmit as a single distributed array, coherently combining their individual transmissions and concentrating energy toward a distant receiver. In this way the range and data rate of tactical networks can be increased compared to the traditional approach in which one radio transmits at a time.

The objective of this project is to design, develop and demonstrate a prototype wireless network employing distributed transmit beamforming for Army communications. The prototype will be based on commercial software defined radios (SDRs) that will be fitted within Army land vehicles for demonstration.

This project commenced in 2017 and will run for three years, during which time the following aspects will be addressed:

• VHF and UHF tactical channel characterisation: Conduct field trials for channel sounding in a number of representative areas, with the measurements used to develop simulation models to guide the design and performance analysis of prototype implementations.

• Scenario and user requirements definition: Define the context for use and evaluate the expected operational performance.

• Wireless network testbed definition and commissioning: Install common SDR hardware and software frameworks for waveform development.

• Analysis of prototype designs: Research potential approaches to frequency, phase and symbol synchronisation and mechanisms for providing feedback on channel state to array nodes.

• Prototype system implementation: Development including signal processing, non-linear radio frequency effects, error correction coding and network protocols.

• Conduct of field trials: Series of field trials culminating in a demonstration with around 10 nodes on Army vehicles in an area representative of tactical deployment.

This project is a collaboration between DST (Lead: Stephen Leak), Data61 (Lead: Dr Hajime Suzuki) and the University of South Australia (Lead: A/Prof Gottfried Lechner). It is supported by the Next Generation Technologies Fund managed by DST.

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