COMMUNICATIONS IN BUSHFIRES

by

Prof. Mal Heron

Abstract:
This talk presents work inspired by a NSW Coroner’s Report in the 1970s that concluded that the loss of radio communications was a significant contributor to a tragedy at a fire front. Starting from first principles of Maxwell’s Equations the story is told of how physics and electrical engineering produced an operational conclusion, a PhD graduate and more than a dozen journal papers.

E-m wave propagation equations are written for a gaseous, partially ionised medium and it is shown theoretically that radio wave attenuation should depend on ion density and collision frequency between free electrons and neutral particles. A range of experiments are described, starting with uncalibrated observations using small outdoor fires (at HF) and proceeding to controlled fires in a laboratory situation (microwave), and a large fire in a sugar cane field. This leads to the conclusion that fuel with high alkali content, and especially potassium, and lower frequencies in the VHF and HF bands give enhanced attenuation. It is always better to use higher frequencies (above 1 GHz) and to communicate back across burned ground or upwards to satellites in operation fire control operations.

About the speaker:
Mal Heron PhD, FIEEE, FIEAust. is a retired Professor of Physics, James Cook University, Australia, and is CEO of the Research and Consulting Company PortMap Remote Ocean Sensing. He graduated with BSc in Physics, MSc Hons I in Physics, and PhD in Radio Science all from The University of Auckland. He joined James Cook University in 1971 and has served in several roles from teaching to research and administration.

His research interests are in Radio wave propagation in the environment, Physical Oceanography, Mesoscale Meteorology and the Physics of Remote Sensing.

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