DISTANCE BETWEEN ELECTRONIC DEVICES AND AVALANCHE TRANCEIVERS ON A PROFESSIONAL SKI PATROL

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ABSTRACT: Cellular phones and two-way radios are indispensable communication tools for professional ski patrollers. It has been well established that electronic devices cause interference with avalanche transceivers, including negative effects on range and signal recognition. Transceiver manufacturers and researchers recommend a minimum distance of 40-50 cm between electronic devices and a transceiver during a search. The purpose of this study was to determine if professional ski patrollers at Big Sky Resort are adhering to these guidelines and to raise awareness of the interference issue among patrollers. Thirty three patrollers participated in a study that consisted of two parts: a brief oral survey of electronic device use during work hours and distance measurements between the patroller's transceiver and electronic devices during a simulated search. I found the average distance from transceiver to cellular phone was 33 cm and distance to radio was 29 cm. Distance to the cellular phone varied depending on where the phone was carried and over two thirds of the study participants reported that they have experienced interference during a search. Interference at these distances, while present, is minimal and should be easily recognized and overcome by a competent professional rescuer.

KEYWORDS: avalanche rescue, transceiver, electronic interference

1. INTRODUCTION

When in close proximity to a searching transceiver, electronic devices can decrease effective search range and make it difficult for the transceiver to distinguish between background noise and an actual signal from a buried transceiver. Meister and Dammert (2014) present a series of dramatic figures visually illustrating what a searching transceiver "hears". They showed that an electronic device in close proximity to a transceiver in search mode will increase the noise floor (base level of noise between beeps), making it difficult for a searching transceiver to recognize a signal from a sending transceiver. A digital camera at 18 cm created a noise floor of nearly the same amplitude as a sending transceiver at 50 m distance, possibly causing the transceiver to recognize a signal when none is present ("a ghost signal") or not recognizing the real signal at all. Meister and Dammert (2014) recommended a minimum separation distance of 50 cm between a searching transceiver and electronic devices to prevent this type of interference.

Barkhausen (2012) performed range tests with several types of interfering objects at varying distances from a searching transceiver. He found that while different combinations of transceiver brands and electronic devices have different effects, there is a general reduction of range when an electronic object is placed near a searching transceiver. He recommended a beacon in search mode be held at least 40 cm away from any electronic device that is on. The 40-50 cm separation distance recommended in these studies is consistent with the recommendations of other researchers and avalanche transceiver manufacturers with most trending toward 50 cm.

All patrollers at Big Sky Resort are required to carry a two-way radio during work hours, and the vast majority carries cellular phones. The phones are not required, but are a very valuable communication tool when the radio airwaves are busy or when conveying a long message. While

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the specific focus of this experiment was to determine if ski patrollers at Big Sky are abiding by the recommended separation distance between transceivers and electronic devices, I had a more general goal of increasing the awareness and technical understanding of interference between transceivers and electronic devices among my co-workers. I found a considerable amount of research establishing that interference does occur, but little concerning people's habits of using electronic devices while using transceivers. In talking to many experienced patrollers, they were well aware of interference and many stated that they had experienced interference at work. This made me curious whether we were actually abiding by the recommendations. This project was initially planned to be presented as part of our annual snow safety refresher.

2. METHODS

I conducted a simple experiment that included two parts: a short oral survey and measurements between the patroller's transceiver and radio and cellular phone during a simulated search.

All participants in this experiment were on-duty professional ski patrollers at Big Sky. To start the survey, participating ski patrollers were asked to begin a transceiver search. A few seconds into the signal search phase, they were asked to stop and hold their body position. I then asked if they were carrying a cellular phone and where it was. I used a simple metric measuring tape to measure the distance from transceiver to phone and transceiver to radio while the patroller was holding their position.

Questions included in the survey were:

- Are you carrying a cellular phone and where is it located?
- Is your phone currently on, off or in airplane made?
- Have you ever experienced interference during a transceiver search?
- Besides your radio, are you carrying any other electronic devices?

3. RESULTS

I surveyed 33 on-duty professional ski patrollers. Two-thirds of the patrollers surveyed (22) reported that they had experienced interference during a transceiver search. Only two were carrying electronic devices (an ipod and a second cellular phone) in addition to their two-way radio and cellular phone. The average distance between searching transceiver and two-way radio was 29 cm (Fig.1).

Two patrollers were not carrying cellular phones. Of the other 31, the average distance between transceiver and phone was 33 cm (Fig. 1). This falls well below the commonly recommended separation distance of 50 cm.

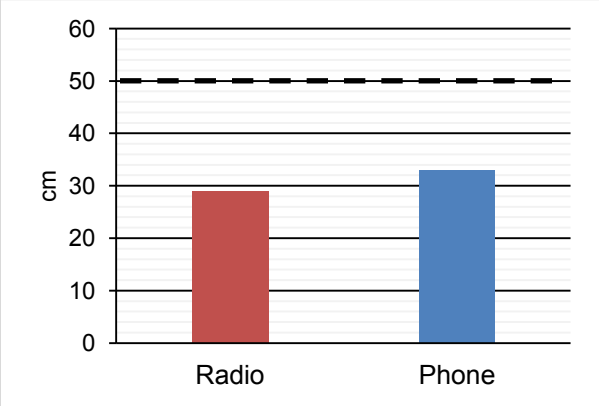

Fig. 1: Average distance between searching transceivers and electronic devices. The dotted line represents the common recommendation of 50 cm between transceivers and electronic devices.

Most survey participants had their phones on during the survey. Only one person had their phone off (Fig. 2).

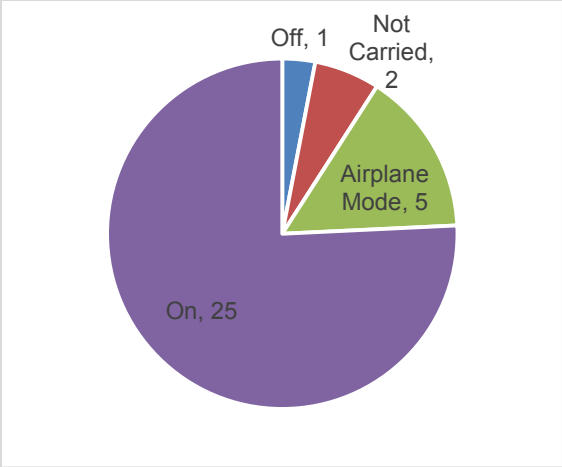

Fig. 2: Phone status (off, not carried, airplane mode, or on).

All patrollers in the survey wore their radios either in a chest harness or chest jacket pocket. Phones were carried in several distinct locations (Fig.3). I grouped the locations into five categories: Cargo (mid pant leg), Chest, Coat (lower than a chest pocket, but above the waist), Hip, and Backpack. Cargo was the least popular with only one participant while chest and hip had the most with 11 and 12, respectively.

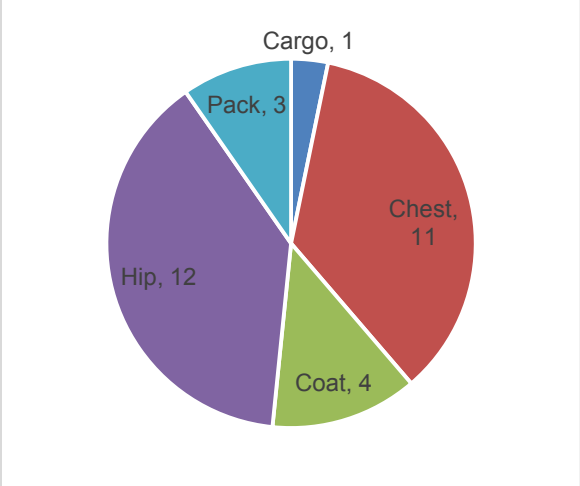

Fig. 3: Cellular phone storage location; number of patrollers.

Despite the small sample size, differences were apparent in the distance from phone to searching transceiver when grouped by location carried (Fig. 4). Only one participant carried a phone in his cargo pocket and that location produced the shortest distance in the survey: 9 cm. Three participants had their phones in their backpack on the day of the survey and their distance averaged 67 cm, the only carrying location that exceeded the recommended distance. Chest, coat and hip pockets accounted for roughly 85% of survey participants and the transceiver separation distance of these three categories all fell below the recommended distance of 50 cm.

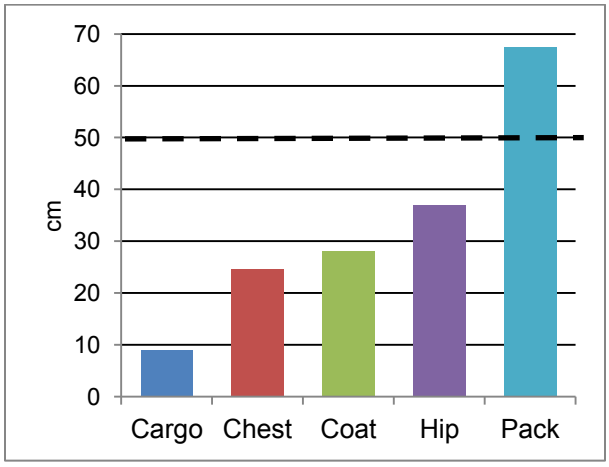

Fig. 4. Average phone-transceiver distance grouped by phone location. The dotted line represents the common recommendation of 50 cm between transceivers and electronic devices.

4. CONCLUSIONS

Most patrollers in this study had their phones and radios closer than the recommended separation distance of 50 cm between electronic devices and transceivers. The average distances 33 cm from a cellular phone and 29 cm from a radio are potentially close enough to cause a reduction in search range, but unlikely to cause a searching transceiver to consistently interpret the interference as a false positive signal.

Two sure ways to reduce the possibility of interference are to either forgo carrying electronic devices or to turn them off. Cellular phones are often used for communication on a professional ski patrol and it may not be practical to do either. The results of this study suggest that moving a cellular phone into one's hip pocket or, better yet,

backpack will reduce the amplitude and possibility of interference.

At Big Sky, professional ski patrollers are required to do a practice transceiver search at least once per week. These searches are self administered at various locations across the mountain. The simulated searches start out as simple single burials at the beginning of the season and become increasingly complex as the season progresses. Since patrollers perform these searches during the work day, their radios and cellular phones are on and in normal carrying positions. During the 2015-16 season, several patrollers noted electronic interference during a practice search and were able to attribute it to a device they were carrying. All of those patrollers reported that they were able to complete the practice search successfully. The frequency and realism of this practice allows patrollers to be able to recognize interference, if present, and continue to carry out a successful search.

This study was presented at Big Sky Ski Patrol's snow safety refresher in the fall of 2015. The presentation included a discussion of research into interference, a case study where interference was thought to have contributed to a failed search and the death of a patroller at Pra Loup Ski Resort in France in 2000, demonstrations of interference using both digital and analogue transceivers, the methods and results of this experiment and a discussion of policy and practice to reduce interference. Both new and veteran patrollers found the information useful, particularly the visual representation of interference from Meister and Dammert (2014) and the sounds produced by an analogue transceiver as a cellular phone was brought to within 5 cm.

This simple study helped foster discussion and awareness of the phenomenon of transceiver interference within our ski patrol. Several patrollers commented during the 2015-2016 season that they had changed their habits with regards to cellular phone use (i.e. turning phones off during work hours or keeping phones in a backpack instead of pockets). This greater awareness combined with regular, realistic search practice contributes to patrollers being able to minimize and overcome the potential effects of interference between transceivers and electronic devices.

CONFLICT OF INTEREST

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