

# PERCEIVED URGENCY OF NON-VERBAL AUDITORY ALARMS IN THE CH146 GRIFFON HELICOPTER

G. Robert Arrabito, Todd A. Mondor, and Kimberley J. Kent  
DCIEM, 1133 Sheppard Ave. W., P.O. Box 2000, Toronto, ON M3M 3B9

## INTRODUCTION

Non-verbal auditory alarms in the cockpits of aircraft are intended to alert the aircrew to a present hazard, to indicate the degree of danger of the hazard, and to suggest corrective action. When alerted by an alarm, the aircrew may continue to perform the ongoing task(s), make further observations concerning the alarmed condition, or take immediate action to address the alarmed condition. In many instances the perceived urgency conveyed by alarms is inadequate due to an incorrect mapping of the alarm's psychoacoustic parameters to the triggering situation (1). Accurate coding of urgency may increase detectability and reduce the time to address the alarmed condition.

The present research was undertaken to determine if the psychoacoustic parameters of the non-verbal auditory alarms in the CH146 Griffon helicopter convey the appropriate level of danger. Ratings and rankings of the perceived urgency of these alarms were measured.

## METHOD

**Subjects.** Three groups of subjects participated, comprised of 25 male pilots of the CH146 Griffon helicopter, 25 female non-pilots, and 25 male non-pilots.

**Stimuli.** The stimuli were five non-verbal auditory alarms presently used in the CH146 Griffon helicopter. The names of these alarms are Crypto (signals encrypted radio message), ELT (emergency locator transmitter), Low Rotor (indicates rotor speed has dropped below preset RPM value), Radalt (indicates aircraft has descended below preset altitude), and Selcal (signals an in-coming call on high frequency). These alarms were digitally stored as single channel sound files on the hard disk of the host computer.

**Apparatus.** Testing took place in a quiet room. The room contained the host computer, monitor, keyboard, and chair. Procedure. Subjects were individually tested in the quiet room. The subject's task was to indicate the perceived urgency of an alarm presented over headphones (i.e., to rate the importance of the heard alarm based solely on its acoustic properties). The source of the heard alarm was not revealed to the subjects. A rating scale was used to make the judgements, with 0 indicating low urgency and 100 indicating extreme urgency. Following a training session, 50 trials comprised of 10 cycles of a random ordering of the 5 alarms, were presented. Subsequently, the pilots were required to complete a questionnaire in which they were asked to rank the urgency of the CH146 Griffon helicopter alarms. The purpose of the questionnaire was to compare the perceived level of urgency with the urgency of the triggering situation.

## RESULTS AND DISCUSSION

Preliminary data analysis are given. A between- (group having three levels) and within-subjects (alarm having five levels) ANOVA on subjects' median ratings of perceived urgency revealed that the only significant main effect was alarm ( $p < 0.0001$ ). A Tukey pairwise comparison ( $p < 0.05$ ) revealed that the means of ratings of perceived urgency for all alarms significantly differed from one another with the exception of Radalt and Crypto. The ELT alarm was perceived as the most urgent, followed by Low Rotor, and then Selcal. The Radalt and Crypto alarms were perceived as being the least urgent. Participants' ratings of perceived urgency appear to be based on the acoustic properties of the alarms. Previous research has shown that physical characteristics such as frequency composition, repetition rate, amplitude, and harmonic relation of the frequency components can significantly influence the listener's interpretation of the urgency of an auditory alarm (1).

For each alarm, a Spearman correlation was performed between the pilots' median ratings of perceived urgency and their corresponding ranks of that alarm as indicated in the questionnaire. All correlations yielded non-significant results ( $p > 0.05$ ). These findings are in agreement with (2) who found no significant correlation between the rating of perceived urgency of auditory alarms used in hospital operating rooms when judged by practicing anaesthetists and the clinical urgency as judged by senior anaesthetists.

In summary, the five tested alarms have different levels of encoded urgency, but these are poorly mapped to the urgency levels of the triggering situations.

## REFERENCES

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