

I See Red!

Red Light Illumination in Helicopter Air Ambulance Services

Patrick Schober, MD, PhD, DESA, MMedStat;
Lothar A. Schwarte, MD, PhD, MBA, DESA, EDIC*

ABSTRACT

Helicopter air ambulance services (HAA) increasingly operate during darkness, and the cockpit crew prefers a dimmed light to be used in the cabin. Our HAA team is currently researching the use of dimmed red light. We encountered a downside to the use of red light—some texts and symbols became virtually invisible.

KEYWORDS: *helicopter; air ambulance; red light*

Introduction

HAA increasingly operate during darkness, with the respective challenges.^{1–3} Herein, the cockpit crew (i.e., the HAA pilot and the flight nurse) prefer for the HAA physician to use a dimmed light in the cabin or patient compartment.

Use of Red Light in Nighttime Operations

In this context, our HAA team is currently researching the use of dimmed red light for operations in darkness (e.g., during night flights) in the medical cabin compartment of the helicopter. Compared with standard white light, sources from tactical operations (i.e., the military and law enforcement) suggest there are advantages to the use of colored light,^{4–6} including red light,⁷ for nighttime operations. A major advantage of dimmed red light reportedly is better-preserved scotopic vision (i.e., darkness adaptation of the eyes) compared with equally bright standard white light.

Results

In contrast to the advantages of red light currently under investigation, we encountered a relevant downside of red light use in our HAA operation that might not be ubiquitously known. When using dimmed red light in our HAA operations, we encountered that texts and symbols printed in red on a white background, and vice versa, became virtually invisible. This phenomenon was confirmed with the use of three different red light sources (one torch and two head lamps) from different manufacturers.

Examples of this optical phenomenon, termed metamerism,⁸ were found both for the helicopter's interior and for our medical equipment, including the current propofol and etomidate medication ampules. This phenomenon is exemplified in Figures 1 and 2. The disappearance of red text on a white background, and vice versa, can be expected in red ambient light, particularly if no alternative light source is present. HAA crews and other service personnel operating with dimmed red light in darkness should be briefed and aware of this pitfall. In addition, HAA teams may modify their medical equipment accordingly (e.g., by adding alternatively colored medication labels). If in the future the use of red light becomes widely distributed in helicopter night operations, helicopter manufacturers may also need to reconsider their red/white print schemes on the helicopter's interior warning signs. One solution could be the use of alternatively colored warning signs, where background and text prints are not red on white (as in Figure 2) but instead are, for example, black on yellow.

Multiple types of metamerism have been classified.^{9–11} The specific type described here, termed light source metamerism or illumination metamerism,⁹ may be defined as “two colors apparently differing under one illumination, but appearing equal under another illumination.” It is the most well-known type of metamerism. In the maritime sector, printers of naval maps and charts are widely replacing pure red color with magenta (i.e., 50% red ink, mixed with 50% blue ink), intending to increase readability under red ambient lighting (e.g., that of the ship's bridge).¹² Illumination of printed standard colorized maps with blue or green light will obscure the recognition of water or vegetation, respectively. However, because in our helicopter operation we have not used printed maps for years, not even backup maps, these notions are less relevant to our specific helicopter operation and validity cannot be confirmed from our experience.

Conclusion

We describe metamerism as a possible risk factor for crew and patient safety during HAA nighttime operations when red light sources are used.

*Correspondence to Lothar A. Schwarte, MD, PhD, MBA, DESA, EDIC, De Boelelaan 1117, 1007 MB Amsterdam, the Netherlands or L.Schwarte@VUmc.NL

Drs Schober and Schwarte are affiliated with the Department of Anesthesiology, Amsterdam University Medical Center, Amsterdam, and HAA Life Liner 1, Trauma Center, Amsterdam, the Netherlands.

FIGURE 1 Example of “disappearance” of white letter print on a red background under dimmed red light conditions. The upper third of the vial’s medication label has a bright red background with white letters printed on it, stating the contained drug and drug concentration (propofol 20mg/mL). The text is clearly visible in daylight and in white light mode of the head lamp (A) but disappears under red light condition (B). Photo taken in the medical (passenger) compartment of our Airbus H-135 HAA helicopter at night, illuminated only with a commercial head lamp (Black Diamond®).



FIGURE 2 Example of complete “disappearance” of red letter print on a white background under dimmed red light conditions. The two photographs show the same section of the medical (passenger) compartment of our Airbus H-135 HAA helicopter. (A) Taken in daylight. (B) Taken in darkness, illuminated by a commercial head lamp (Black Diamond®) in red light mode.



References

- Peters JH, et al. Helicopter emergency medical service patient transport safe at night? *Air Med J.* 2014;33(6):296–298.
- Dery M, et al. Results and recommendations from the helicopter EMS pilot safety survey 2005. *Air Med J.* 2007;26(1):38–44.
- Salazar G, Temme L, Antonio JC. Civilian use of night vision goggles. *Aviat Space Environ Med.* 2003;74(1):79–84.
- Pedler M, et al. Red-green versus blue tactical light: a direct, objective comparison. *J Spec Oper Med.* 2017;16(4):54–58.
- Calvano CJ, et al. Tactical lighting in Special Operations medicine: survey of current preferences. *J Spec Oper Med.* 2013;13(4):15–21.
- Aydin A, Bilge S, Eryilmaz M. Safest light in a combat area while performing intravenous access in the dark. *J R Army Med Corps.* 2018;164(5):343–346.
- Van Buren JP, et al. Optimizing tactical medical performance: the effect of light hue on vision testing. *J Spec Oper Med.* 2018;18(2):75–78.
- Dexter FC, Stearns EI. Example of metamerism; extreme example of color change with varying illuminant. *J Opt Soc Am.* 1948;38(9):816.
- Oulton DP, Taylor H. Inter-observer agreement on visual colour matches and the role of metamerism as a cause of disagreement. *Surface Coatings Int Part B-Coatings Trans.* 2002;85(2):105–109.
- Edwards SJ. Throwing light on metamerism, quantifying the change in a color match caused by change of illuminant. *Leonardo.* 1989;22(2):215–218.
- Long DL, Fairchild MD. Modeling observer variability and metamerism failure in electronic color display. *J Imaging Sci Technol.* 2014;58(3).
- Newson DW. Nautical chart standardization. *Int Hydrographic Rev.* 1984;61(2):111–122.



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