Input paper: ENG4-9.7.1

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Agenda item 9

Technical Domain / Task Number 2 Visual Signalling

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Visual Perception of Non-Rectangular Flashes at Threshold and Supra-Threshold

# Summary

## This latest visual experiment, in a series of experiments carried out by the General Lighthouse Authorities' Research and Radionavigation Directorate (R&RNAV), studied the conspicuity of non-rectangular flashes of light at observer illuminance levels at and above the threshold of perception (supra-threshold).

## For the supra-threshold experiments, a single experienced observer matched the brightness of flashes to a steady light at 0.2 microlux, the illuminance level from which the night time luminous range of a marine aid to navigation light is calculated. Six different flash profiles were observed: rectangle (control); rectangle with 100Hz pulse-width modulation; asymmetrical triangle with a rising edge; asymmetrical triangle with a falling edge; symmetrical triangle; and Gaussian. The durations of these flashes varied from 0.025 seconds to one second. The aim of the experiment was to ascertain how different flash shapes and durations affect conspicuity and to ascertain the best method of modelling the conspicuity of a marine aid to navigation light.

## Results showed that several existing methods of effective intensity evaluation gave significant errors when applied to the flash profiles observed, including the IALA recommended Modified Allard Method (MAM). However, when the visual impulse response function in the current MAM model was modified by using a mathematical 'shear transformation', a better fit to the observed data was obtained. As with other studies at this supra-threshold level, a visual time constant of 0.1 seconds was found to give a better fit to data than the 0.2 seconds used at threshold levels. Since the term 'effective intensity' is only valid at the threshold of perception, the term 'apparent intensity' is used in this document to quantify supra-threshold conspicuity.

## Recommendations include using the Modified Allard Method with a 'shear q3' visual impulse function and a visual time constant of 0.1 seconds for the determination of apparent intensity of marine aid to navigation lights at 0.2 microlux illuminance. Presentation of the results of this experiment to IALA and CIE is also recommended, along with a request to review the term 'Modified Allard Method'.

## Purpose of the document

The two papers presented here detail the method used in the experiments and the results obtained. The paper ENG4-9.7.2 is for the experiments carried out at threshold, and is provided here largely for information and as supporting documentation. The conclusions of paper ENG4-9.7.3 on the supra-threshold experiments is considered to be of more of more relevance to the IALA ENG Committee, and the authors would kindly ask the Committee to consider the results and conclusions of this document in future developments.

## Related documents

ENG4-9.7.2 – Visual Perception of Non-Rectangular Flashes at Threshold

ENG4-9.7.3 – Visual Perception of Non-Rectangular Flashes at Supra-Threshold