

# A computer based tool for cognitive workload measurement in marine operations

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## **Abstract**

The UK Maritime and Coastguard Agency has commissioned research to develop a tool to assess mental workload in marine operations. This is intended be used proactively, e.g. to determine safe manning levels, and also retrospectively, during accident investigations. A comprehensive literature review was performed and is provided in the full report, which is available on the Maritime and Coastguard Agency website (Embrey et al., 2006). This revealed that few existing tools included factors that are widely recognised by mariners as crucial influences on mental workload in the marine context. The research approach involved eliciting the factors perceived as the main influences on workload from groups of experienced seafarers. Predictive models based on these factors were developed interactively using a computer program developed in earlier research, and then tested by evaluating scenarios that had been experienced by the expert groups. The predictions of the model were compared with those of the groups and the model was then adjusted until a match was achieved between the predictions and the perceived workload of the mariners in the scenarios evaluated. This was repeated with a number of groups, and a combined model was developed. This was encoded as the engine for a computer program called CLIMATE (Cognitive Loading Index Measurement and Assessment TEchnique). CLIMATE assesses the conditions associated with maritime tasks, and calculates the extent to which loading is likely to exceed acceptable levels. CLIMATE also allows 'what if' analyses where the assessments can be manipulated to determine the most cost effective changes to achieve desirable levels of loading.

## **Introduction**

Analyses of shipping and other accidents have indicated that three states of cognitive mental workload may act as precursors or contributory factors. Underload situations, leading to failures to monitor automated navigation systems or maintain effective watchkeeping may arise in the classical vigilance task environment of low demands, unstimulating environments and uncertain signals. Overload situations arise where excessive demands to diagnose or respond may exceed attentional or cognitive resources. Transitional situations arise where there is a rapid change between the between an underload and overload state, e.g. in response to a suddenly identified

In D. de Waard, G.R.J. Hockey, P. Nickel, and K.A. Brookhuis (Eds.) (2007), *Human Factors Issues in Complex System Performance* (pp. 85 - 100). Maastricht, the Netherlands: Shaker Publishing.