

A Multiple Sensor Fusion Framework for Evaluating Human Factors in Demanding Marine Training Operations

F. Sanfilippo, L. Vederhus, P. Ekelund, and H. P. Hildre
 Department of Maritime Technology and Operations
 Aalesund University College
 Postboks 1517, 6025 Aalesund, Norway
 fisa@hials.no

INTRODUCTION

Situational awareness or situation awareness (SA) is the perception of environmental elements with respect to time or space, the comprehension of their meaning, and the projection of their status after some variable has changed, such as time, or some other variable, such as a predetermined event. SA is especially important in work domains where the information flow can be quite high and poor decisions may lead to serious consequences as for maritime applications. This project will provide new tools for understanding of risks due to human influence during demanding marine operations. This project aims to transform the simulators into research laboratories by instrumenting and operating them for studying complex socio-technical relationships. Methods to capture operations performance and risk assessment taking into account human factors will be developed. This project will provide new insights as to how to reduce risk in demanding marine operations. The direct industrial relevance for this project concerns the assessment of risk and risk reduction in demanding marine operations due to (1) operational plans and procedures, including unique operations before they take place in reality; (2) equipment and system design.

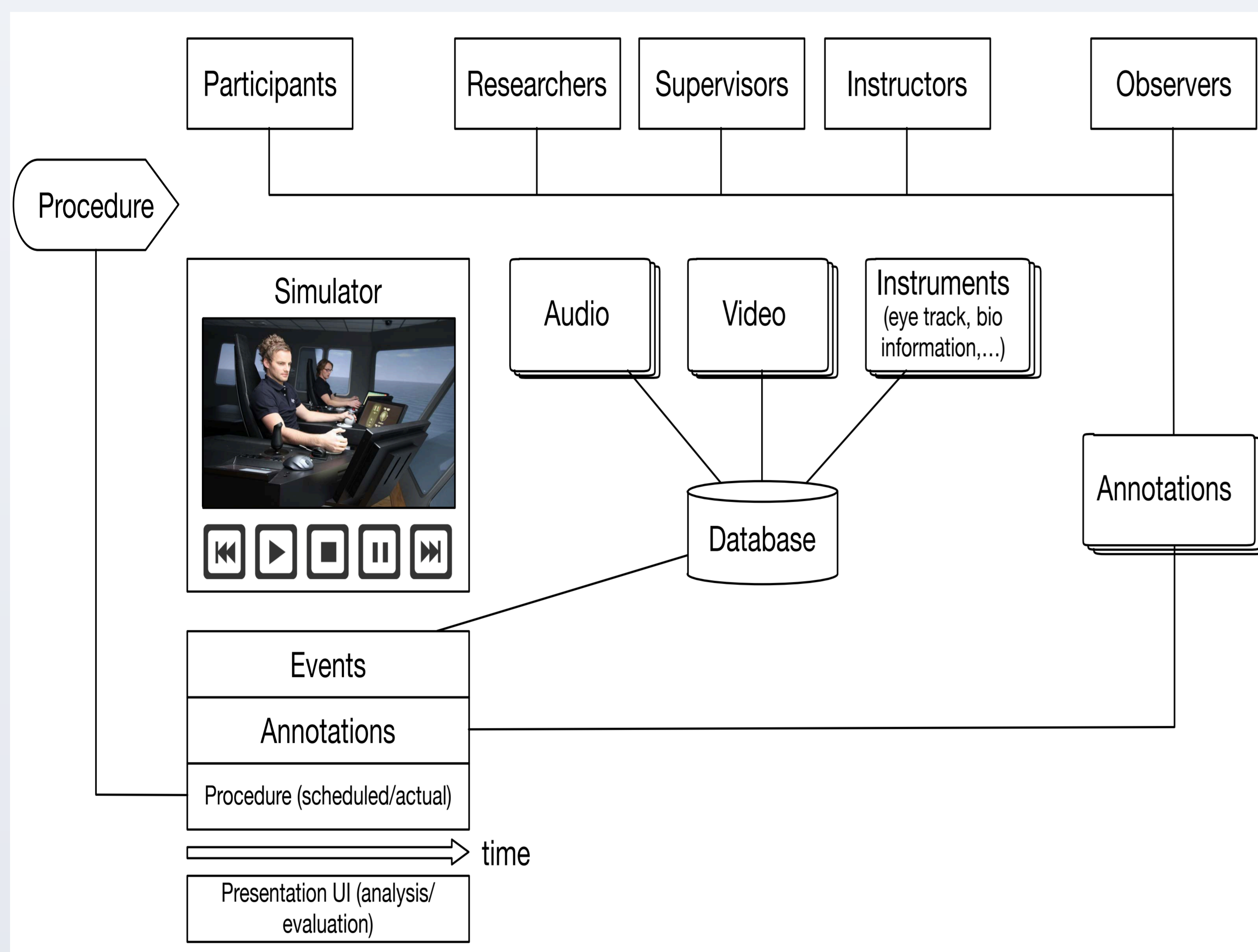


Fig. 1. The proposed multiple sensor fusion framework.

BACKGROUND

In order to improve safety of offshore installations the classic methodology for risk estimation is usually applied. A generally accepted definition of risk among experts is the danger unwanted events may have on human, environmental, and economic values [1]. The Offshore Safety Case regulations holds operators responsible for identifying the major hazards and to reduce risks to As Low As is Reasonably Practicable (ALARP). The regulations specifically state that Quantitative Risk Assessments (QRA) must be used when preparing the Safety Case. However, this formal risk estimation does not necessarily correspond with an individual's perception of risk. Taking this into consideration, improving the user's risk perception plays a crucial role in effective risk reduction. There is an urgent need to develop faster methods and tools that enhance an individual's perception and assessment of dangerous situations on board a vessel so that accidents can be avoided [2, 3]. Developing and testing such methods in a real set-up environment is very difficult because of the challenging operational workspace of maritime installations. Due to the challenging operational scenarios in real applications, a promising approach consists of using sophisticated training programs within specifically designed simulator environments. Training programs have had success in reducing risk and improve efficiency of marine operations by training in simulators to improve overall understanding of operations to be performed. Illustrative techniques to visualize procedures, and thereby further improve (shared) SA, are lacking, though. There is an immediate and urgent need to develop procedures that can be communicated and shared by the crew and objective methods and tools that will help us understand SA with greater accuracy and thereby a more complete understanding of the risks during a demanding marine operation.

OBJECTIVES

Our vision is to develop an integrated framework for planning, executing and assessing demanding marine operations by adopting corresponding risk evaluation tools that take human factors into consideration and focus on SA. To fulfill this vision it is needed to instrument and operate simulators as research laboratories that allow for studying personnel executing demanding marine operations in a near real-life environment. The primary objective of this project is to develop a new integrated

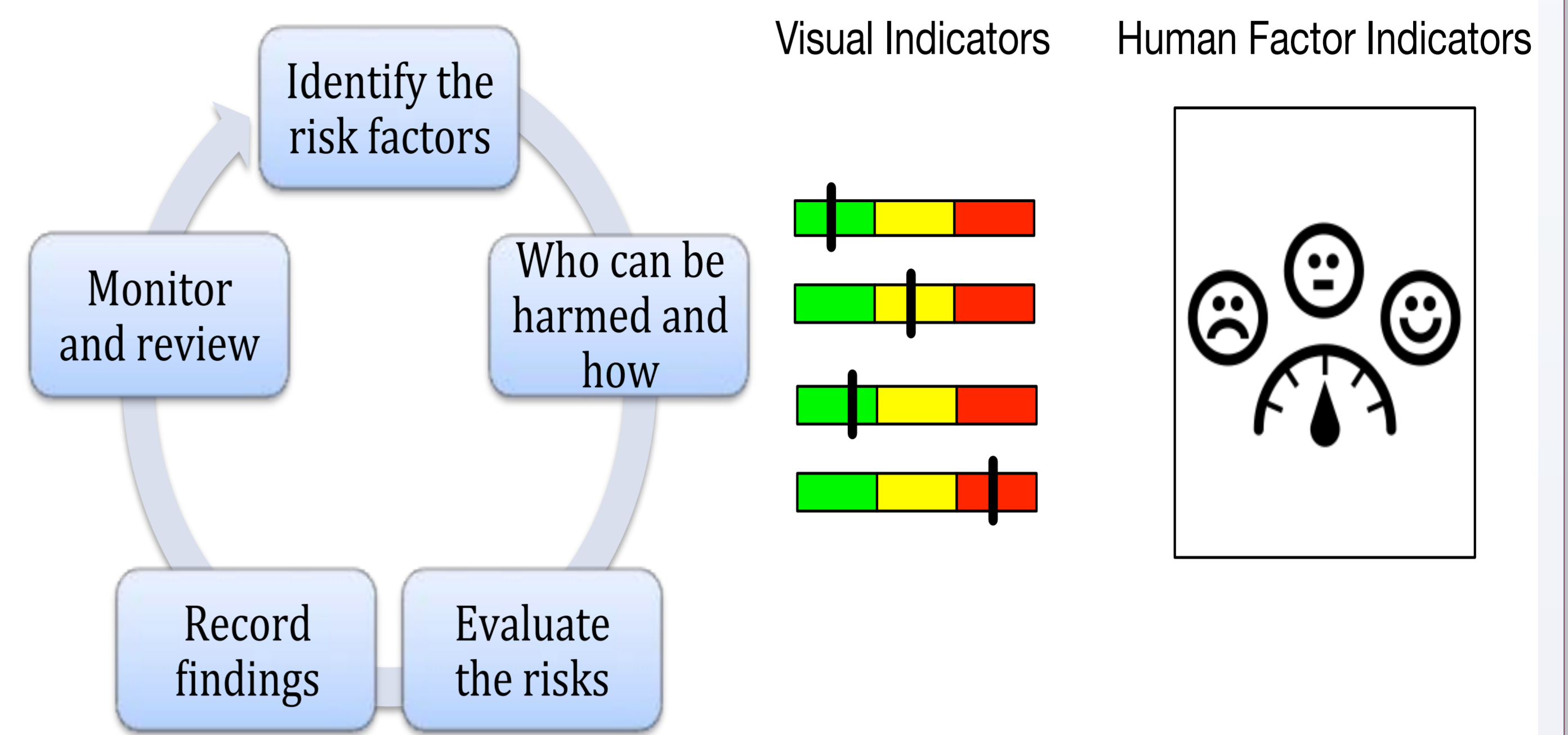


Fig. 2. The proposed risk management framework with the idea of providing human factors visual indicators.



Fig. 3. The idea of using eye trackers for maritime applications.

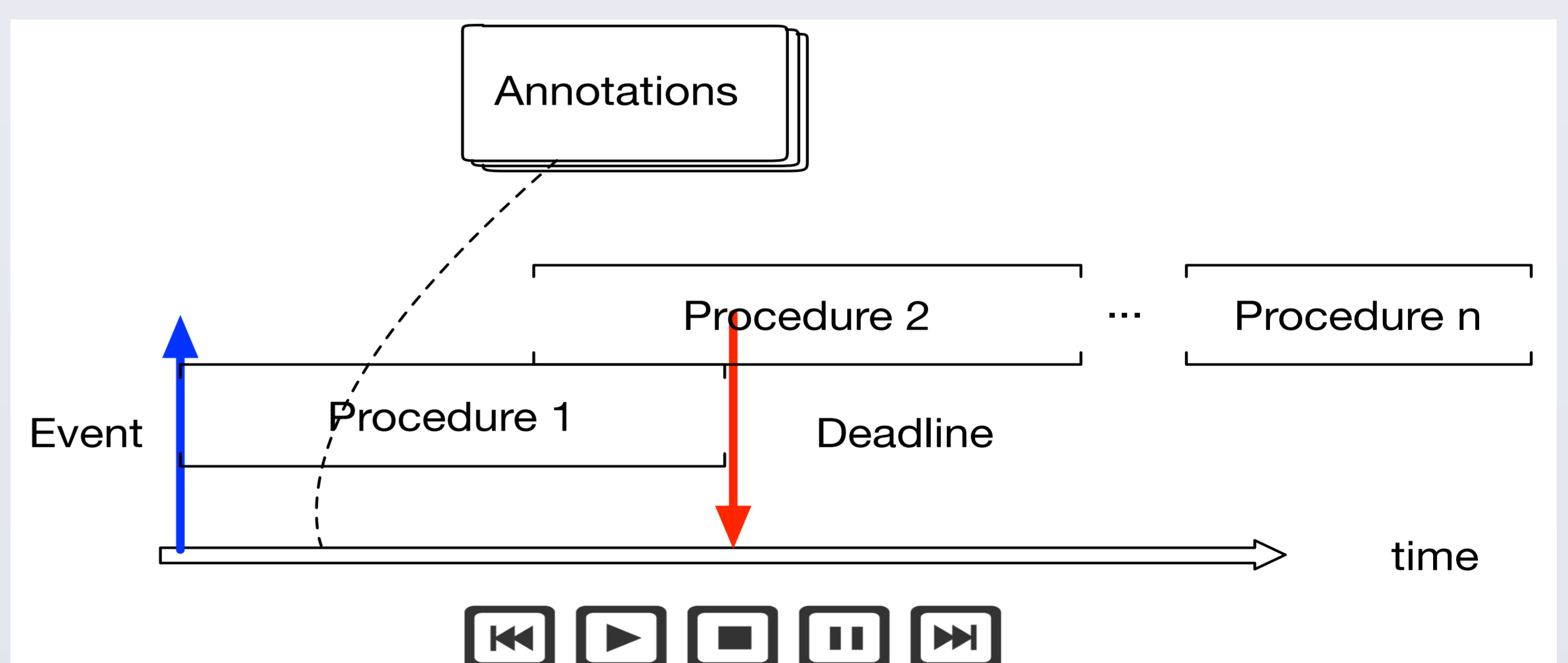


Fig. 4. The idea of realising a timeline to playback different procedures.

sensor-fusion framework, shown in Fig. 1, for planning and execution of demanding marine operations. This concept is shown in Fig. 2, highlighting the proposed risk management framework with the idea of providing human factors visual indicators. Different tools may be employed as shown in Fig. 3 and Fig. 4.

Our secondary objectives are:

- to develop models that allow for identifying and evaluating the risks of maritime operations;
- to identify, evaluate, and rank different risk reduction measures and metrics for SA;
- to develop instrumentations and methods for assessment of SA as an integrated part of simulation training.

REFERENCES

- [1] R. Bye and G. M. Lamvik, "Professional culture and risk perception: Coping with danger on board small fishing boats and offshore service vessels," *Reliability Engineering & System Safety*, vol. 92, no. 12, 2007, pp. 1756-1763.
- [2] F. Sanfilippo and K. Y. Pettersen, "Xbee Positioning System with Embedded Haptic Feedback for Dangerous Offshore Operations: a Preliminary Study," In *Proc. of the MTS/IEEE Oceans '15 Conference*, Genova, Italy, 2015.
- [3] F. Sanfilippo and K. Y. Pettersen, "A Sensor Fusion Wearable Health-Monitoring System with Haptic Feedback", submitted to the *Proc. of the 11th IEEE International Conference on Innovations in Information Technology (IIT'15)*, Dubai, United Arab Emirates, 2015.