About SAFE

SAFE is a predictive fatigue tool that was designed from original work completed by the Institute of Aviation Medicine (IAM) in the 1970s. IAM later became part of the UK Ministry of Defence's (MoD) science research group, the Defence Evaluation and Research Agency (DERA), located at the site of the Royal Aircraft Establishment, (RAE) Farnborough, England. In 2001, most of the research agencies belonging to MoD were privatised, and absorbed into a new company, QinetiQ Limited, whose headquarters remained at the Farnborough site.

The original studies into human fatigue were carried out with UK Ministry of Defence funding to describe fatigue in humans and understand fatigue during potential sustained and intensive air operations.

The base model for all subsequently occupationally tailored models, includes the sleep homeostat, circadian rhythm and sleep inertia and models that are based on these three elements are now known as "three-process models". This "three-process" base model was developed during the 1970s and 1980s and called "The CHS model", after the Centre of Human Sciences, the name of the department formed in 1995 within DERA from IAM and Army and Navy research groups.

Over the subsequent 25 years and more, a series of targeted studies were conducted using volunteer pilots from several airlines across the world that covered long haul, short haul, ultra-long haul and cargo operations. A very significant and comprehensive database was created from these studies that were used to create the SAFE software model.

Version 5.0

During 2001 the initial version 2.09 was distributed to the airline industry to gain feedback on its usability and value. As a result of this exercise the model was further developed with the addition of more features to increase usability. The basic algorithms calculating sleep and fatigue did not require any change. Version 5.0 was delivered to UK CAA for its exclusive use in 2003.

Importantly, the sleep studies conducted in the cockpit to assess the quality of sleep during in-flight rest with augmented crew were completed before 2001, when airline security was massively increased after the New York Twin Towers tragedy. After 2001, the increase security measures and general awareness amongst the travelling public about possible terrorist acts from humans wearing any form of electrical wiring, rendered such studies essentially impossible to complete.

Happily, the required study data was already collected by the IAM team and secured, but other model providers that started their studies after 2001 (which includes all alternative models) were not so fortunate.

Since then, the model has been used by both CAA and QinetiQ in their respective work within the airline and defence industries and in 2011, the Intellectual Property was licensed exclusively to Fatigue Risk Management Science Limited who, since then have further refined the algorithms by incorporating additional study data and improved reliability, security, scalability and resilience by developing the model into an application that is hosted on the Microsoft Azure Cloud. Version 5.5 was available to the aviation industry from 1st January 2012 and this version, version 10, is available from 1st July 2023.

Version 5.5

Version 5.5 differs from Version 5.0 in that version 5.0 is a product designed exclusively for UK CAA, whilst version 5.5 was designed as a tool both for airlines and regulators to predict the likely fatigue levels in any given duty for the average pilot.

As SAFE and CARE are tools, not decision-making systems, it is important that the output of the model is correctly driven by the correct datasets to ensure delivery of the appropriate analysis. Similarly, the subsequently interpretation of the scores that drive any subsequent action taken because of the analysis, will be based on the user's understanding of human fatigue, fatigue counter measures, and the risk appetite for their airline. Accordingly, all users of the model must receive appropriate training in not only how to navigate and use the model, but also how to interpret the output data to implement the best choice of strategy to manage fatigue in aircrew.

Version 6.0

Versions 6.0 onwards incorporates optional access to the Cabin crew Alertness and Rest Evaluation model (CARE) that is designed for cabin crew. CARE was built on the same principles as SAFE using data from cabin crew. CARE is available as an option for those who require it. CARE adjusts the in- flight rest timings and on-board facilities available as well as adjusting the workload to reflect the more fatiguing activities of cabin crew.

Version 7.0

Version 7.0 was released when the SAFE and CARE application was rewritten for the Microsoft Azure Cloud hosting platform. The Azure Cloud system provides clients with improved security, resilience and scalability and is an ISO27000 certified platform. Each client retains separated databases, and all data is encrypted both in movement and at rest.

On-demand air taxi operators are particularly processor hungry, so all clients are now likely to have access to more than enough processing power for their needs for the foreseeable future.

As version 7.0 is much more powerful, it is necessary to put limits on the performance of SAFE in order to contain the negative effects of any errors in data upload. This is particularly important for users of the API who drive data directly from their rostering programmes. A simple error that sends huge datasets to SAFE when it was hosted on a single server with a shared processor would cause the processor into overload and the system would slow down and ultimately seize up.

Version 8.0

With the new version 8 architecture, an overload of data will cause more processors to be added to handle the load. This means that clients will consequentially drown in the amount of data provided by SAFE and Microsoft will issue a very large invoice for processing services.

Version 9.0

Versions 8 and 9 had improvements to the IT system that augmented security and additional features added, mostly providing better usability. However, it became clear on 2019 that a complete rewrite was required to take advantage of some significant improvements in the Azure hosting platform to improve workflow, security and usability. More features were also developed and were ready for inclusion in the next upgrade, planned as version 10.

Version 10.0

Version 10.0 has a higher performance as workflow has been streamlined and new features added both at the IT level with Single-Sign-On (SSO) and two-factor authentication as well as modelling features that improve the granularity and score of analysis.

It also has a Duty Risk metric included that considers both the risk of becoming fatigued and the nature of the risks to human performance caused by the operational requirements of each duty. This metric is particularly useful for operations where consideration of the fatigue scores alone does not represent the risk to operations adequately. There are times when fatigue scores are low but risk is high; and vice versa.