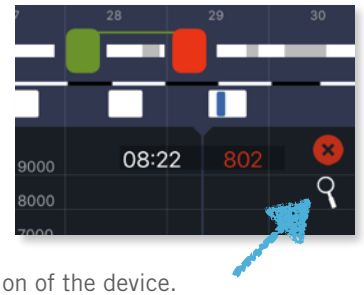
Fatigue Causes - Go Into Detail With Predictions

Use the **Fatigue Causes** Functionality to Reveal the Reasons Behind Fatigue

Fatigue models are fairly complex mathematical descriptions of human physiology. Sometimes, at least if you have a developed interest in modelling and the physiology, you might like to learn more about how model sub-components and mechanisms are contributing to predicted low alertness. In CrewAlert the answer is just a tap away.

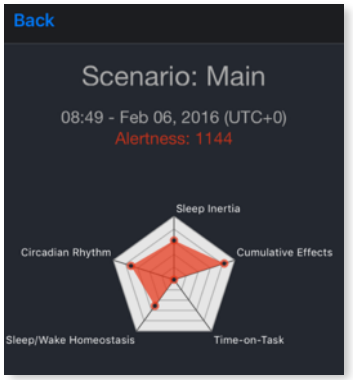
Initiating Fatigue Causes

In CrewAlert Pro, from version 3.9, you can easily initiate this detailed mode, found only in *analysis mode*, by tapping the magnifying glass in the top right corner of the graph view. On the iPhone you will only find it in portrait orientation of the device.



The Radar Chart Display

The magnifying glass will bring up a screen containing a radar chart displaying the "magnitude" of the contribution of the different subcomponents in BAM. The magnitude is plotted on a scale from 0 in the center, to 100 on the outer edge. Note that this visualisation is self-relative, meaning 0 equals the minimum contribution and 100 the maximum. It does not reflect the relative contributions between the components. (Two components both at 100 may contribute quite differently to the total.)



So what is then the meaning of the different sub-components?

Sleep inertia. The temporary fatigue contribution that comes from waking up. Sleep Inertia will reach its maximum value right after waking up, and then decrease rapidly. A rule of thumb is that after 15 minutes sleep inertia has dropped with a third and 30 minutes later it has dropped with an additional third. The last third is mostly gone 2 hours after waking up. Spontaneous awakenings have a lesser amount of sleep inertia than external awakenings.

Circadian Rhythm. The fatigue contribution that comes from the circadian pacemaker. The Circadian Rhythm is governed by your body's internal biological clock. It is independent of the amount of preceding sleep and wakefulness, but is affected by the light/dark cycle over a 24 hour period. The Circadian Rhythm is not only regulating the sleep/wake pattern, but also feeding patterns, core body temperature, and other biological activities. The Circadian Rhythm will need some time to adjust to a new time-zone (a process known as acclimatisation). The Circadian Rhythm is one of the components of the Two-Process Model of Sleep Regulation, and is a major component in most models of sleep and wakefulness.

Sleep/Wake Homeostasis. The fatigue contribution that comes from the historic sleep/wake pattern. This comes from the accumulation of hypnogenic substances in the brain which generates a homeostatic drive for sleep. The longer the time awake, the stronger the fatigue contribution from Sleep/Wake Homeostasis, but missing sleep in the sleep history will also increase this fatigue cause. This is one of the components of the Two-Process Model of Sleep Regulation, and is a major component in most models of sleep and wakefulness.

Time on Task. The fatigue contribution that comes from work-time since the last sleep. This component will be 0 on off-duty days, and it will increase as work-time increases.

Cumulative Effects. The fatigue contribution that comes from working consecutive days. These are work-pattern driven effects that are not related to the actual work-time, but rather to consecutive days of work creating additional fatigue. This component will reset after a sufficiently long off-duty period (typically two physiological nights) and builds up as the number of days since last off-duty period increases.

Concluding Remarks

Keep in mind that models are models, not reality. Significant individual variance around the model output is to be expected. Please contact us via frm@jeppesen.com if you have questions, or suggestions for improvements.

A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties.

ICAO definition of fatigue

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