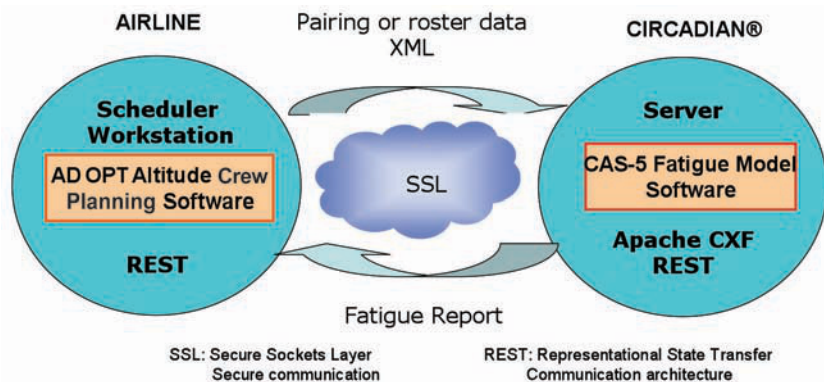# CAS-5
Fatigue Risk Module for Crew Planners

A scientifically-validated fatigue risk model is a vital tool in aviation Fatigue Risk Management Systems (FRMS). The Circadian Alertness Simulator (CAS) is the longest operationally-used fatigue model with a 20 year validated record of reducing errors, incidents and injuries in FRMS applications. This has been achieved by using the fatigue risk outputs of CAS to modify and progressively optimize duty-rest schedules.

The latest release of CAS (**CAS-5**) is specially optimized for crew planning and other airline FRMS applications. Special modeling features in CAS-5 address the specific fatigue risks of Commuter, Long-Haul, Ultra Long Range (ULR) passenger, freight and corporate aviation operations.

Integration of CAS-5 Fatigue Model with AD OPT's Altitude™ Crew Planning Optimization Solutions

CIRCADIAN and AD OPT division of Kronos offer a state-of-the-art fatigue and alertness module powered by CAS-5 which is fully integrated with AD OPT's market leading airline crew planning optimization solutions. By providing crew planners with secure web access to the CAS-5 server from AD OPT's Altitude Crew Planning Optimization Solutions suite, airline planners can:

a. **Altitude Pairing's crew pairing generation:**
Undertake instant fatigue risk assessment during the build, to identify pairings that need re-work to avoid excess fatigue risk.

b. **Altitude BLISS's bidline generation:**
Test bidlines for excess chronic fatigue build-up, and make corrections before publishing

c. **Altitude PBS & Altitude Rostering's Preferential bidding systems:** Provide fatigue risk feedback as bids are built.


XML packets of data are sent to and from the Altitude software and the CAS-5 server to provide rapid desktop feedback to the crew schedulers on any fatigue risk in the crew pairings or bidlines they are building.

How CAS-5 Altitude Works
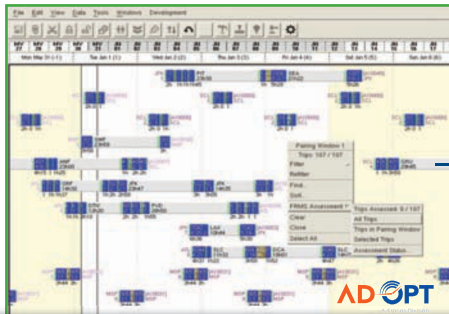
Input crew pairing, bid line, crew history from scheduler screen XML data via web interface

Crew planner sends query to CAS-5 about one or more crew pairings or bidlines from their planning screen as XML data packets.
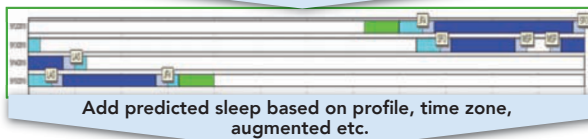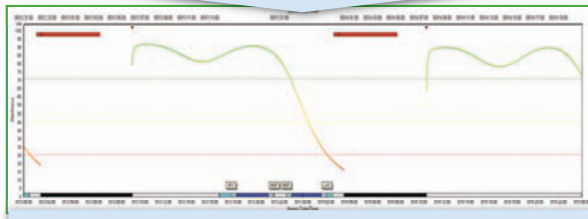

Add predicted sleep based on profile, time zone, augmented etc.

CAS-5 determines time zone shifts between airports, and risk categories (take-off-landing, cruising flight, non-flight duty) for each schedule.
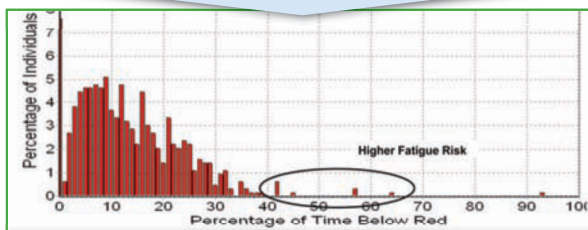

Calculate minute-by-minute crewmember alertness

CAS-5 computes predicted sleep from sleep profiles, circadian & homeostatic factors and sleep opportunities.


Compute fatigue risk

CAS-5 simulates minute by minute alertness throughout each crew pairing or bidline. Different duty types create different rates of alertness decay to address workload.

Transfer CAS report via web interface Display results on scheduler screen

CAS-5 calculates the aviation-specific risk factors across the full range of crew pairings or bidlines, and identifies those with highest risk, which would be suggested candidates for schedule re-work.
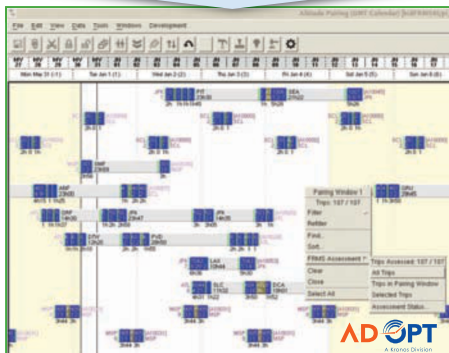
CAS-5 results are sent back as XML data packets to the Altitude system and displayed in user-friendly format on the crew scheduler's Altitude screen.

Required Types of Input Data	For each data set the following is required: • Type of data: crew pairing, bidline, day-of-operations history • ID of the flight pairing or roster and/or individual pilot • Home airport code of the flight pairing or roster or individual • Begin and end time and date of each duty type episode (Pre-flight briefing, Flight, Post-flight debrief, Deadhead, Ground Duty) • Augmented or non-augmented crew • IATA Airport codes of the Origin and Destination of each flight
Optional Additional Input Data	The precision of the CAS-5 analysis can be improved by providing more data if it is available. For example this may include: • Sleep data from actigraph or log recording. • Sleep personality type of each individual (owl/lark (morningness/eveningness); short/long sleeper; napper/consolidated; flexible or rigid sleeper) • Quality of sleeping location: Home, hotel (inflight: economy/business/bunk); • Time from airport to home, crashpad or hotel (shortened sleep opportunity) • Individual's residence zip or postal code
Methods of Inputting Data	CAS offers multiple routes for data transmission: • Transmission via XML packet via web interface (used by AD OPT Altitude interface) • Import of Excel file with data in required fields (Useful for large scale batch processing) • Manual entry of flight-rest schedule data at computer screen.
Fatigue Risk Determination	Fatigue risk is not simply the level of alertness at any particular time, because people can compensate especially when the length of time with reduced alertness is short. Other composite measures are more robustly predictive, including: • Average on-Duty Alertness Level • Percentage of Duty Time Below Red Threshold • Chronic Fatigue Score

Other Aviation FRMS applications of CAS-5	CAS-5 is a valuable tool at all stages of FRMS design, implementation and operation, including.
	• FRMP/FRMS Planning
	• Crew Planning: Crew Pairings, Bidlines and Bidding
	• Aircrew Education & Sleep Planning
	• Reserve Policy Design & Evaluation
	• Fatigue Reports And Incident Investigation
	• Aircrew Fatigue Research & CAS-5 Optimization.
	• FRMS Audits
CAS-5 scientific basis	CAS-5 uses the laws of circadian sleep physiology to estimate the duration, timing and quality of sleep for each sleep opportunity before, during and after any given duty-rest schedule. It then uses a three-process model which combines homestatic factors (build up of sleepiness during wakefulness and dissipation during sleep), circadian factors (the phase of the human biological clock and its adjustment to time zones), and sleep inertia (the transitory impairment of alertness on arousal from sleep depending on circadian phase, length of sleep and level of prior sleep deprivation).These laws are derived from the extensive scientific research literature which is currently being published at the rate of over 5,000 articles a year.
	CAS has then been progressively optimized over 20 years using large populations of equipment operators where sleep and alertness on duty has been simultaneously measured.
	CAS has been shown to be highly effective in progressively driving down the rate of errors, incidents and injuries caused by fatigue. This is achieved by using CAS fatigue risk outputs in a feedback loop to identify and minimize high fatigue risk duty-rest schedules.

About CIRCADIAN

CIRCADIAN® is the global leader in fatigue risk management systems, and 24/7 workforce performance solutions for businesses that operate around the clock. From our global offices in North America, South America, Europe, Asia, and Australia, we provide consulting expertise, research, training, products and software tools to help extended hours operations optimize employee performance and reduce the inherent risks, costs, and liabilities of running a 24 hour operation.

For more information about CAS-5 or Aviation FRMS Solutions, contact CIRCADIAN® at info@circadian.com or visit our website at www.circadian.com.

CIRCADIAN® can help you construct the FRMS jigsaw and provide the missing pieces

FRMS Implementation Consulting

AIRCREW FATIGUE TRAINING

FRMSWatch
Actigraphy

SLEEP

Aircrew Fatigue/Sleep Data Collection
Data   Analysis

FACTS
Fatigue Incident Analysis

ASAP

CREW PLANNING

Optimize Pairings Bidlines

CAS-5 FATIGUE MODEL

FATIGUE REVIEW COMMITTEE
Train   Certify