



DATASHEET Fatigue Risk Management Solutions

# FAID<sup>®</sup> | Fatigue Assessment Tool by InterDynamics

## About InterDynamics

InterDynamics is a leading provider of decision support and risk management methodologies and software. Servicing an international market, our extensive client base spans the spectrum of shiftwork and safety-critical industries, including transportation, mining, logistics, healthcare and manufacturing.

**Fatigue Risk Management Solutions:** Helping businesses identify, assess and manage the risks associated with work-related fatigue at both operational and management levels.

**Decision Support Solutions:** Helping organisations plan and schedule their business operations more effectively.

Our collaborative approach to customer service also helps us stand out from the crowd. Our experienced team can call on a wealth of problem-solving expertise to offer advice that is both practical and implementable.

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**Please contact us to find out more on this or our other offerings**

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FAID is an internationally recognised bio-mathematical model used to estimate fatigue exposure associated with hours of work.

As part of an overall company Safety Management System, FAID can assist in identifying fatigue exposure and tracking the effects of associated risk improvements to hours of work.

The association between hours of work and occupational health and safety outcomes is widely accepted (Caruso, Hitchcock, Dick, Russo & Schmit, 2004). FAID allows policy makers and organisations to manage and audit work-related fatigue in a systematic and practical way.

## FAID methodology

Using formulae and factors developed and validated by Dr Adam Fletcher and Professor Drew Dawson at the Centre for Sleep Research, University of South Australia, FAID was created to provide a representative score of the fatigue exposure of a worker based on the following biological determinants of fatigue:

1. Time of day of work and breaks
2. Duration of work and breaks
3. Work history in the preceding seven days
4. Biological limits on recovery sleep

A FAID Score indicates the likely sleep opportunity that a work-pattern allows. As the relative sleep opportunity associated with a work-pattern decreases the FAID Score increases.

Scores between 80 and 100 are equivalent to the predicted level of work-related fatigue achieved after 21-24 hours of continuous sleep deprivation (Dawson, Reid, 1997). Performance impairment at the same levels of sleep deprivation has been associated with a blood alcohol concentration over 0.05% (Fletcher, Lamond, van den Heuvel, Dawson, 2003).

FAID sits as one of the flagship tools within Our Risk-Based Approach to managing fatigue.

FAID can assist in the analysis of:

- Roster plans and the comparison of different potential work patterns
- Fatigue exposure impacts of various start and finish times
- Appropriate overtime selection, in conjunction with other risk-based controls
- Compliance of actual and planned rosters against organisational fatigue tolerance levels
- Changes in estimated fatigue exposure within shifts based on the hours worked

Our Risk-Based Approach has been developed in partnership with Zurich Risk Engineering.

FAID is recognised and used by regulators and key industry players around the world within the Aviation, Rail, Road, Mining, Marine, Customs, Police, Health, and Emergency Services sectors.

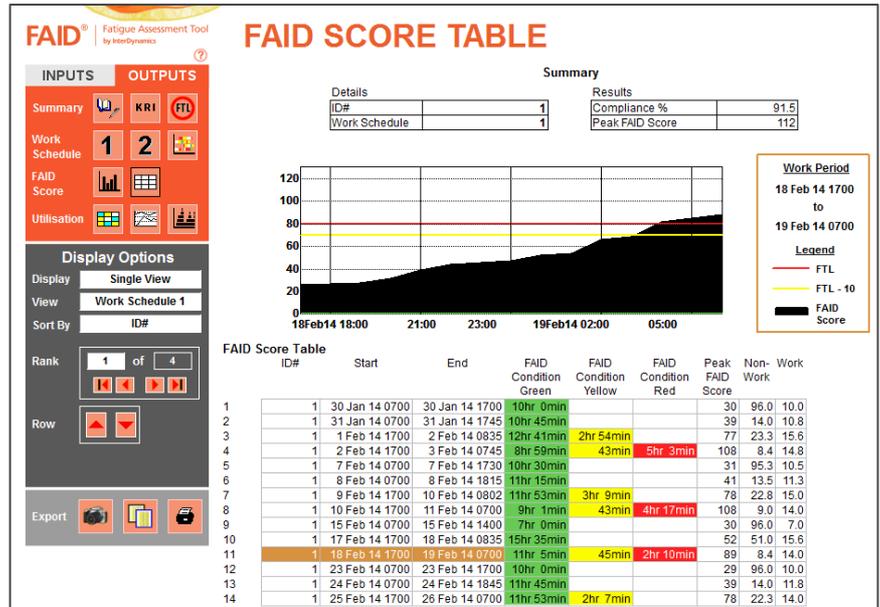
Simple and easy to use

Data requirements are simply:

- Staff or work pattern ID
- Shift start date and time
- Shift end date and time

ID	Start date & time	End date & time
10142	24/08/2010 17:30	24/08/2010 04:30

Data can be easily copied to and from spreadsheets



How FAID can contribute to your Organisation's Fatigue Risk Management System (FRMS)

Organisations use FAID as both a starting point to assess indicative levels of Hours of Work related fatigue by providing a Score that is a measure of the sleep opportunity available within the Hours of Work, and as a powerful integrated tool within their ongoing FRMS program.

- FAID provides a scientifically validated metric of indicative fatigue exposures within Hours of Work, allowing organisations to apply appropriate levels of risk mitigation treatment/controls to ensure work is performed within acceptable levels of risk.
- In conjunction with a Fatigue Hazard Analysis Risk Assessment and organisational safety metrics, a FAID score benchmark (Fatigue Tolerance Level) may be set and rostered against, as an Hours of Work-related control. This complements other controls that form part of an organisation's fatigue management procedures within its Safety Management System.
- As a compliance monitoring function, comparison of actual Hours of Work against the plan (including reference to the Fatigue Tolerance Level) can be made, providing information for exception investigation, and a measure of system integrity.
- Roster planning decisions, including the allocation of overtime, can be enhanced by the use of FAID in conjunction with consideration of other work-related fatigue factors, to ensure levels of fatigue exposure in Hours of Work are within appropriate boundaries.
- FAID outputs assist in the process of Accident and Incident investigation by assessing the potential contribution of Hours of Work-related fatigue to a safety event.

### **Fatigue Risk Management**

**System:** *A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge that ensures relevant personnel are performing at adequate levels of alertness.*

The International Civil Aviation  
Organization

FAID is not a difficult product to use, however we do recommend **training in the context and functionality of FAID** to assist in its most effective and appropriate usage.

**FAID has been used operationally within industry worldwide since the early 2000's, and continues to prove itself useful as a decision support and risk mitigation tool. This in itself is a powerful validation of its usefulness within an organisations FRMS toolkit.**

FAID scores provide an indicative measure of exposure, and do not necessarily indicate the level of individual fatigue. Exposures need to be assessed in relation to individual risk factors, the tasks being undertaken, existing mitigating treatments/controls, and the potential likelihood and consequence of an occurrence in order to gain an understanding and appreciation of the risk involved.

### **Defining the Scores Produced**

The scoring system is representational in nature. A 40 hour standard work week of Monday to Friday 0900 to 1700 hours would achieve a FAID score of 41.

By comparison, a 40 hour week that was also Monday to Friday but with work hours from 2300 to 0700 would achieve a FAID score of 97.

A study by Dawson and Reid<sup>1</sup> indicates that scores between 80 and 100 (high fatigue likelihood) are comparable to the level of fatigue-related impairment after 21-24 hours of continuous sleep deprivation. This result was observed when the sleep deprivation started at 8 a.m. on a Monday, following a standard working week and weekend break. Multiple studies (Fletcher, Lamond, van den Heuvel, Dawson, 2003) have shown that performance impairment at such a level of sleep deprivation is comparable to that experienced at blood alcohol concentrations of over 0.05%.

### **FAID Training Workshop**

The key objectives of the workshop are to ensure participants have a good understanding of FAID software functionality, and how to interpret and use FAID outputs, including:

- Estimating hours of work related fatigue exposure using FAID & Hours of Work data.
- Interpreting FAID Scores.
- Analysis of planned rosters and actual hours of work data.
- Using FAID to support decision making (e.g. designing rosters, adding shifts to working rosters, for auditing purposes, etc.).

The training also discusses:

- Benefits and use of FAID within an FRMS;
- Key science and assumptions behind FAID; and
- Using FAID within the operational context.

Workshops are generally between 4 and 6 hours, and it is recommended that workshops be kept to a maximum size of 8 attendees per workshop.

### **Background on the Model**

Developed using scientific research and knowledge gained over several decades on circadian factors, the effects of shift lengths, timing of shifts and the importance of previous work periods on fatigue and performance, FAID is a bio-mathematical model of human alertness response to work and rest patterns.

The formulae and factors behind the model have been developed and validated within the Centre for Sleep Research's own facility (University of South Australia), within simulated work environments, and in field-based situations.

The development and validation work is considerable, and has been published in a range of international peer-reviewed journals and books (see references 1 to 28 on following pages).

## InterDynamics' Risk-Based Approach includes:

- **Hours-of-Work Diagnostic Reports**

By providing 12 months of actual and planned Hours-of-Work data, analysis and recommendations can be made on your historical and planned position in relation to Hours of Work fatigue exposure.

When complete, a FAID diagnostic can usefully complement one or more Fatigue Risk Management Solution Educational Workshops.

The same data may also provide the basis for starting a Fatigue Hazard Analysis Risk Assessment Workshop, utilising a Zurich Risk Engineering validated approach.

**FAID v2.2 can analyse 12 months of data for 100+ employees in less than 10 seconds.**

Our aim is to provide you with the best tools and resources possible. We believe in continuous improvement and flexibility, to ensure FAID is responsive to client feedback and kept abreast with current research and national and international risk management standards.

Ask us about FAID Roster Tool, FAID Time Zone, FAID Business Wide, FAID Shared Object Library, HAZAID™, GRAID FRMS™, GRAID Investigation Tool™, and Customisations.

The model does not make decisions on which work schedules are most appropriate in specific workplaces. What the model does, however, is provide information that can be useful when decisions about fatigue management need to be made. Tracking FAID Scores in relation to incident frequency, absenteeism levels, employee sick days or other organizationally meaningful data allows a clearer illustration of the relationship between Hours of Work and its related costs.

### Other Variants and Customisations

#### FAID Roster Tool

The FAID Roster Tool is designed to assist organisations that are currently planning or building rosters within spreadsheets. The FAID Roster Tool provides a significant step up in terms of efficiency and functionality, and offers the ability to:

- Import or manually build rosters across numerous groups or depots
- Compare and store auditable planned and actual Hours of Work data
- See immediate feedback of FAID scores as shifts are allocated
- Quickly change shifts or implement shift swaps by a simple 'click and select' method
- Manage designations and availability of staff
- Retain the analytical power of the outputs currently available within FAID
- Utilise easily created roster templates and publish rosters with a click of a button

Depot	Service Number	Name	Desig..	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa											
Depot1	1001	Example Perso..	Operat..	A1200	6	A1200	12	N18	64	M06	46	N18	68	A1400	38	M06	65	N18	81	M06	78	M06	85					
Depot1	1002	Example Perso..	Techni..			M06	15			N18	30			A1400	31	N18	74							N18	64			
Depot1	1003	Example Perso..	Appre..	A1200	6	M06	21	M06	33	M06	57	N18	93												N18	114		
Depot2	1004	Example Perso..	Superc..	M06	15	A1400	39	M06	69	N18	102			A1400	44	M06	74									A1400	38	
Depot2	1005	Example Perso..	Operat..	N18	63									N18	117													
						M06	15	A1400	21	M06	39	M06	61	A1400	43	M06	75	N18	98								A1400	38

#### FAID Business Wide

FAID Business Wide is a compliance-monitoring tool that quickly analyses hours of work data from across the whole organisation. It allows for both high level and drilled down analysis at the organisational, regional, service location, role type or activity level. Comparisons between locations or groups become possible to see where 'hot-spots' with relation to hours of work fatigue exist, for timely treatment.

#### FAID Shared Object Library

FAID can also be supplied as a Shared Object Library for use with third party software. The calling program (typically user supplied rostering or scheduling software) composes a dataset of a single roster and passes it to the Shared Object Library which returns FAID score data back to the calling program.

The process is fast and efficient, and enables existing corporate rostering or scheduling software to take hours of work related fatigue and its risks into account when creating and managing rosters.

#### FAID Time Zone

A specialty version of FAID has been developed by InterDynamics for any industry where workers are routinely required to operate across 3 or more time zones. The aviation industry, in particular Long Haul and Ultra-Long Haul operations, is exposed to higher frequency rates of trans-meridian adjustment



Customisations for reading client data sources, crew augmentation to meet client rules and sleep quality adjustments are available.

Customers are attracted to InterDynamics' Fatigue Risk Management Solutions because they are supported by leading insurers, operational practitioners, and human factors scientists.

and this factor is considered to result in higher levels of fatigue exposure for aircrews.

The following has been determined by the aviation industry in the USA (Battelle Memorial Institute, 1988) – An aircrew's level of alertness at any time depends upon the complex interaction between a number of variables. In particular, five variables need to be considered:

1. Time on task, including flight time and duty period duration
2. Time awake, since last sleep, when beginning the duty period
3. The extent of circadian disruption caused by transiting multiple time zones, and working at night
4. How quickly the pilot returns to home base – the speed of transition
5. Individual sleep debt, be it acute and/or chronic

Use of FAID Time Zone will provide a metric that reports the effect of Items 1, 3 and 4 on the individual's and group of individual's indicative exposure to fatigue.

The method used for calculating the fatigue index when time zone changes apply is to calculate the individual fatigue index for each hour of duty based on the individual's current 'body time'.

An individual's initial 'body time' is based on their starting time zone from the first duty in the work schedule, which is established using the difference between UTC and local time where the first duty commenced. Adjustments to the 'body time' are then made taking into account the rest time and number of time zones crossed.

Adjustment begins at the end of the duty, and the magnitude of adjustments is as follows:

- 1.5 time zones per day when traveling in an Easterly direction
- 2 time zones per day when traveling in a Westerly direction

There are additional rules and exceptions for adjustments being made:

1. There is no adjustment to an individual's 'body time' when the second of two consecutive duties involves a return to the starting time zone of the first duty in the work schedule and either:
  - a. the rest period between the two duties is less than 36 hours<sup>1</sup>, or
  - b. the time zone difference is three hours or less, and the rest period between the duties is less than 48 hours<sup>2</sup>.
2. Any duty performed at the rest period location will not prevent rule one (above) being applied.

**Please contact us for further details on this product and how crew augmentation and sleep quality adjustments are made within FAID Time Zone.**

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<sup>1</sup> A mid-point of 36 hours has been used within FAID Time Zone to reflect the length of time when circadian disruption begins to occur when the second of two consecutive duties returns to the starting time zone of the first duty, to accommodate the 'grey zone' in research knowledge between 24hrs and 48hrs.

<sup>2</sup> Recognising that circadian adaptation is less likely to occur when the time zone difference is three hours or less.

## Related Peer Reviewed Papers and Books

The following list contains the articles in international journals and books which have featured the research behind FAID and its validations.

1. Dawson, D., & Reid, K. (1997). Fatigue, alcohol and performance impairment. *Nature*, July 1997, 388:235.
2. Dawson, D., & Fletcher, A. (2001). A quantitative model of work-related fatigue: Background and definition. *Ergonomics*, 44(2), 144-163.
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5. Dorrian, J., Roach, G. D., Fletcher, A., & Dawson, D. (2007). Simulated train driving: Fatigue, self-awareness and cognitive disengagement, *Applied Ergonomics*, 38, 155-166.
6. Fletcher, A. (1999). Measurement and management of work-related fatigue: Development and preliminary validations of a predictive model. Ph.D. Thesis, 1999, The University of South Australia.
7. Fletcher, A. (2010). Staying Safe in the Jungles of Borneo: Five Studies of Fatigue and Cultural Issues in Remote Mining Projects. *Industrial Health*, 48, 406-415.
8. Fletcher, A., & Dawson, D. (1997). A predictive model of work-related fatigue based on hours of work. *Journal of Occupational Health and Safety – Australia and New Zealand*, 13(5), 471-485.
9. Fletcher, A., & Dawson, D. (1998). A work-related fatigue model based on hours-of-work. In L. Hartley (Ed.) *Managing Fatigue in Transportation*, Oxford, Pergamon Press, 189-208.
10. Fletcher, A., & Dawson, D. (2001). Evaluation of a fatigue model using data from published napping studies. *Journal of Human Ergology*, 30, 279-285.
11. Fletcher, A., & Dawson, D. (2001a). A quantitative model of work-related fatigue: empirical evaluations. *Ergonomics*, 44(5), 475-488.
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14. Fletcher, A., Roach, G.D., Lamond, N. & Dawson, D. (2000). Laboratory based validations of a work-related fatigue model based on hours of work. In: S. Hornberger, P. Knauth, G. Costa, S. Folkard (Eds.) *Shiftwork in the 21st Century: Challenges for Research and Practice*. Peter Lang, Frankfurt am Main, Germany.
15. Lamond, N., Dorrian, J., Burgess, H. J., Holmes, A. L., Roach, G. D., McCulloch, K., & Dawson, D. (2004). Adaptation of performance during a week of simulated night work. *Ergonomics*, 47(2), 154-165.
16. Lamond, N., Dorrian, J., Roach, G. D., McCulloch, K., Holmes, A. L., Burgess, H. J., & Dawson, D. (2003). The impact of a week of simulated night work on sleep, circadian phase, and performance. *Occupational & Environmental Medicine*, 60(11): e13. doi:10.1136/oem.60.11.e13
17. Paradowskie, M., & Fletcher, A. (2004). Using task analysis to improve usability of fatigue modelling software, *International Journal of Human-Computer Studies*, 60(1), 101-115.
18. Roach, G. D., Burgess, H. J., Lamond, N., Dorrian, J., Holmes, A. L., Fletcher, A., & Dawson, D. (2001). A week of simulated night work delays

### 2009 B-HERT Award

Working together to manage Fatigue-related Risk, InterDynamics Pty Ltd, the University of South Australia, and Integrated Safety Support shared an Honorable Mention for Outstanding Achievement in the Collaboration in Research & Development Category.

This innovative collaboration has revolutionised the management of fatigue-related risk and produced an entirely new class of risk management products, which have helped define a new regulatory approach to fatigue management in Australia and overseas, including Canada, Europe, NZ, UK & USA.

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20. Roach, G. D., Fletcher, A., & Dawson, D. (2004). A model to predict work-related fatigue based on hours of work. *Aviation, Space and Environmental Medicine*, 75(3, Section II), A61- A69.
21. Roach, G. D., Lamond, N., Dorrian, J., Burgess, H. J., Holmes, A. L., Fletcher, A., & Dawson, D. (2005). Changes in the concentration of urinary 6-sulphatoxymelatonin during a week of simulated night work, *Industrial Health*, 43, 193-196.

### **FAID Time Zone Specific**

22. Auger, R. R., & Morganthaler, T.I. (2009) Jet lag and other sleep disorders relevant to the traveler, *Travel Medicine and Infectious Diseases*, 7(2), 60-68.
23. Battelle Memorial Institute, JIL Information Systems. (1998). An overview of the scientific literature concerning fatigue, sleep, and the circadian cycle. Prepared for the Office of the Chief Scientific and Technical Advisor for Human Factors, Federal Aviation Administration, Washington, DC.
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### **Other References**

28. Caruso, C., Hitchcock, E., Dick, R., Russo, J., & Schmit, J., (2004). A report on *Overtime and Extended Work Shifts: Recent Findings on Illnesses, Injuries, and Health Behaviours*. Prepared for U. S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Institute for Occupational Safety and Health