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PARLIAMENTARY
ADVISORY COUNCIL
FOR TRANSPORT SAFETY



**WARNING
KEEP AWAKE!**

24TH WESTMINSTER LECTURE ON TRANSPORT SAFETY

Staying Awake, Staying Alive:

The problem of fatigue in the transport sector

DR ROBERT HUNTER - Head of Flight Safety, British Air Line Pilots' Association (BALPA)



3rd UN Decade of Action Lecture

PACTS is grateful for the financial support provided by Direct Line Group.



24th Westminster Lecture on **Transport Safety**

Staying awake staying alive: The problem of human fatigue in the transport sector

**Dr Rob Hunter, Head of Flight Safety,
British Airline Pilots' Association**

Scope

- BALPA's thinking on human factors issues in aviation safety
- Fatigue and sleep science generally
- Management of fatigue in the aviation industry
- Fatigue Risk Management Systems (FRMS)
- Our research plans
- Other transport sectors
- The measurement of fatigue (drowsiness)

Fatigue and sleep science

Generally -

- Invention of artificial light / 24/7 society that is demanding / “TATT” / Addictive and/or intrusive personal and business electronic devices
- The need for sleep and the stages of sleep
- Performance decrements
- Involuntary sleep

The need for sleep and sleep stages

- Around 8 -10 hours is required
- We don't adapt to sleep deprivation
- Without sufficient sleep we are at increased risk of: confusion and memory impairment; depression; hallucinations; heart disease; high blood pressure, diabetes, fits and irritability

...as well as performance decrements and increased risk of involuntary sleep

Sleep stages

5 phases of sleep

Stage 1 Slow eye movements, reduced muscle activity, muscle jerks, sensation of starting to fall, “nodding off”

Stage 2 Eye movements stop, brain waves slow

Stage 3 Further slowing of brain waves, deep sleep, groggy and disorientated if woken

Stage 4 As above but more so

Rapid Eye Movement (REM) Paralysed limbs & dreams

Performance decrements of fatigue

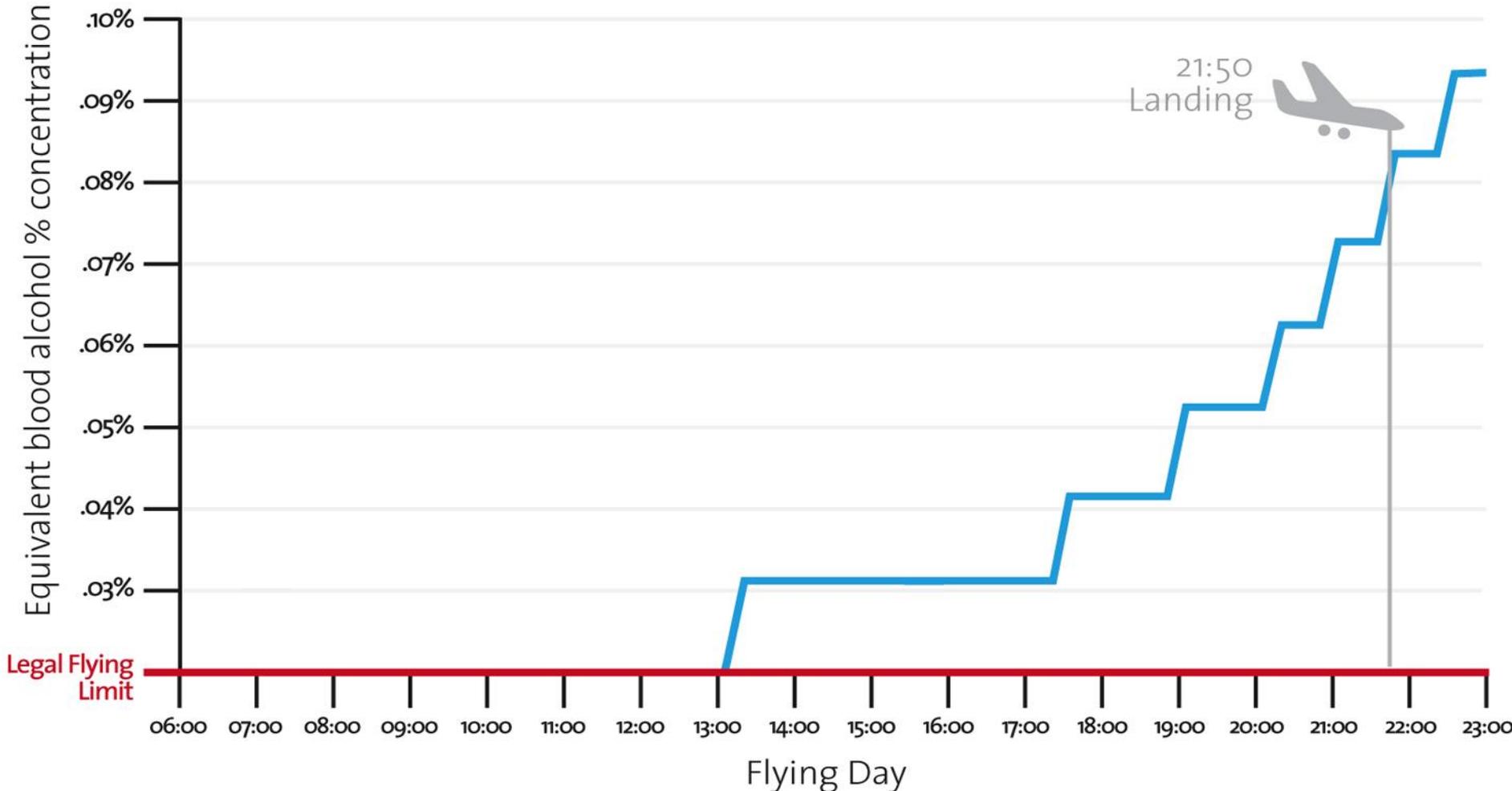
- Reaction time
- Vigilance
- Judgement
- Higher mental functioning
- Inability to deal with the unexpected
- Vulnerability to distraction
- Poor economic decision making
- Greater risk taking, more optimistic
- People may be more or less susceptible to the effects of sleep deprivation depending on their genetic make up

Pilot flying duty hours under new regulations

UK Civil Aviation Authority sponsored SAFE v5 program (v5.5 now current)

Fatigue equivalent blood alcohol concentration

Pilots with an 18 hour flight duty period (awake at 4 am) can be landing aircraft at 4 x the actual alcohol limit



The Karolinska Sleepiness scale

- 1 Extremely alert
- 3 Alert
- 5 Neither alert nor sleepy
- 7 Sleepy – but no difficulty remaining awake
- 9 Extremely sleepy - fighting sleep

BALPA polling results of 500 airline pilots, September 2011

Have you ever involuntarily fallen asleep on the flight deck during 2 crew operations?

Yes = 43%

..and if yes, have you ever woken to find the other pilot asleep?

Yes = 31%

Crew sleep patterns of cockpit napping during transatlantic flights, P. Cabon et al .
XVIth International Symposium on Night and Shiftwork,
17- 21 November 2003, Santos, Brazil.

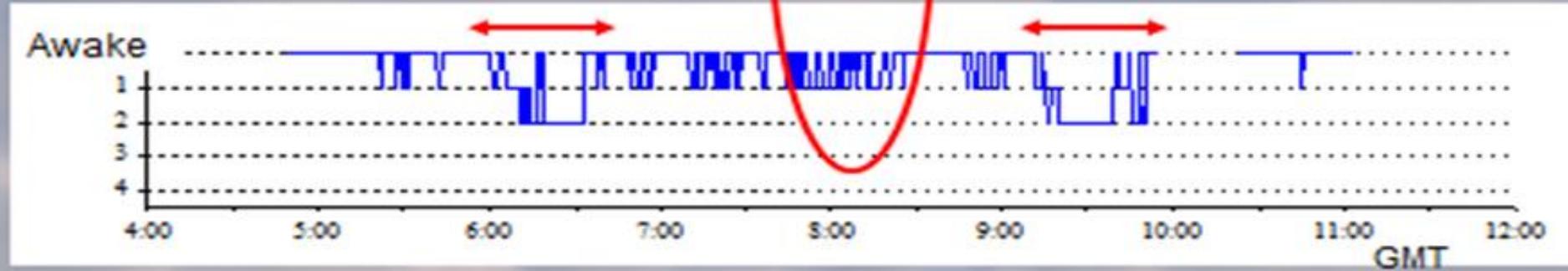


Sleep stages and alertness during flights

New-York -> Brussels - Capt



New-York -> Brussels - First officer



Preplanned rest

Management of pilot fatigue in the UK

- New European Regulations will come into force early next year, generally thought by independent scientists to be insufficiently based on science and medicine and to be a more permissive rule set in the UK.

- Increasing reliance on airline Safety Management Systems

Fatigue Safety Management Systems

- Essentially, the airline owns the risk and sets its own “risk level”
- No definition of what that level is !
- Reporting culture - E.g. only 3 reports of involuntary sleep on UK registered aircraft in a 30 year period.
- Can in effect be a Blame Risk Management System
- Historically revisionist – ignores the reason for the development of prescriptive regulation – typically some form of failure of self-managed risk

“Safety is our number one priority”

.....really?

- ***Drucker –***

- ***“The first duty of an organisation is to survive”***

Where should the line be drawn?

Our research questions -

- How can we measure fatigue?
- How tired is too tired in the piloting context?
- What is the dependence of the risk of involuntary sleep on the sleep state of the other pilot?
- What is the hazard of the pilots drive to and from work after long periods of duty?

...we'll return to these questions later

Other sectors: Roads

- At risk groups: overweight and young males
- Also 12hr night shift workers driving home in the early hours are at particular risk
- Drivers travelling to work in the early hours also at much increased risk, pilots fall into this group.
- For pilots - they probably have a significant fatigue risk when they drive home

Other sectors: Roads

Like flying - subject to under reporting and insufficient enquiry

However, unlike flying –

- Seemingly very high societal acceptance of deaths and injury and road disruption and repair costs
- Driving environment is very intolerant of driver micro sleeps: the sky is big but roads are narrow; and the road environment is target rich.
- Unregulated distractions, phones, sat navs, radios etc
- No prescriptive limits for private vehicles, but commercial vehicle limits are more protective

Other sectors: Roads

Sleep Related Vehicle Accidents (SRVAs)

- Much more likely to result in “killed or seriously injured (KSI)”
- US DoT estimates that every lorry will be involved in one SRVA in the lifetime of the vehicle
- UK national database does not normally record causal factors and surrogates for fatigue accidents may be missed e.g. tyre blow outs
- 29% of drivers admit to having been near to falling asleep at the wheel in the last year

Other sectors: Roads

- On motorways about 20% off all accidents are SRVAs
- SRVAs peak at around 02.00 – 06.00 hrs and 14.00 - 16.00 hrs
- At 06.00hrs drivers are 20x more likely to fall asleep at the wheel than at 10.00hrs
- Typical cost of a SRVA to a lorry on the motorway = £1M

Other sectors: Roads; bicycles, pedestrians and alcohol

- Physical activity is alerting, so KSS of 7 or less are likely
- Cycling - reduction of vigilance is a risk
- Reduced alertness for other hazards, car doors opening etc.
- Pedestrians - the additive effects of even small amounts of alcohol, risks of standing by the road side and at train platforms etc.

Other sectors: Rail

- Train driving – requires high vigilance under monotonous conditions
- 2006 Railways and Other Guided Transport Systems (Fatigue) regulations - sets out requirements for undertakings to manage fatigue risks.
- “Limits” set following the Hinden Inquiry into the Clapham train crash. E.g. no more than 12 hours continuous duty

Other sectors: Rail

- FRMS and fatigue prediction models used
- Fatigue cited in at least 74 railway accidents between 2001 and 2009
- Run back from Shap, 17 Aug 2010, First night shift driver had been awake for more than 18 hours

Other sectors: Maritime

Maritime Labour Convention 2006 Regulation 2.3 –
Hours of work and hours of rest.

Standards of Training Certification and Watch keeping
2010 – Section A-VIII/1 – Fitness for duty.

- 14 hours max daily duty, no more than 72 hours in 7 days

The problem of measuring fatigue

- If this requires operator action it is alerting, intrusive and potentially incriminating
- Fatigue as it is subjectively experienced may not correlate well with performance decrement, which I will call drowsiness...it is context it is drowsiness that matters

Pilot Drowsiness Measurement Research Partners

- Mark Corbett, Swinburne University
- Philip Cabon, University of Paris
- Andrew Tucker, Optalert
- BALPA Flight Safety Department

..allow me to show you the detector

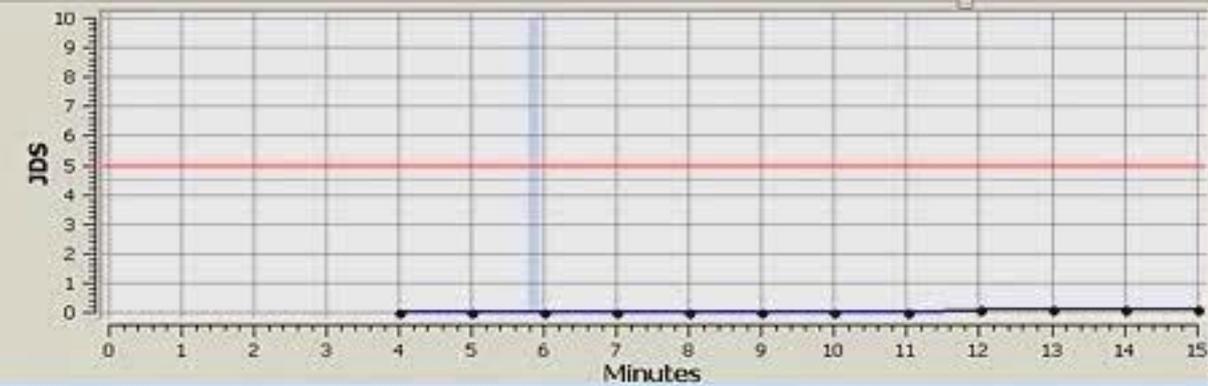
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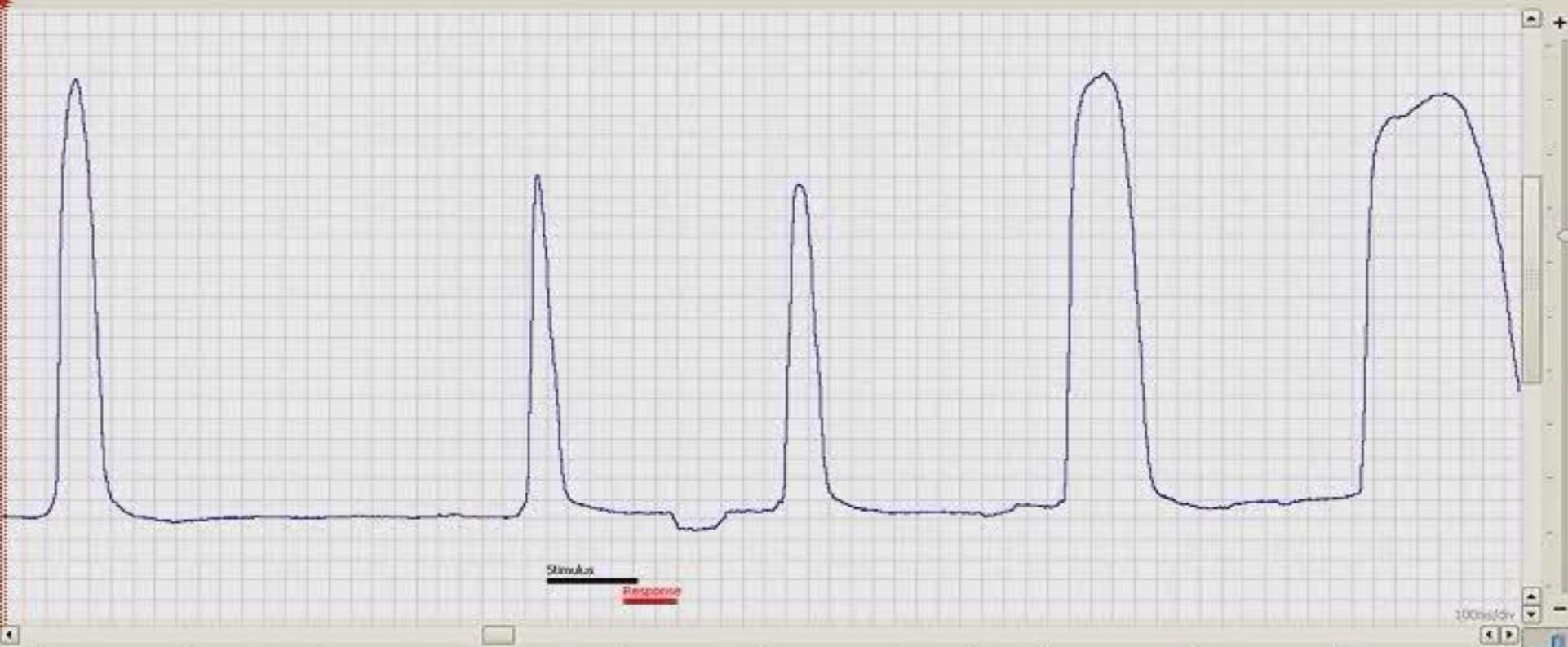
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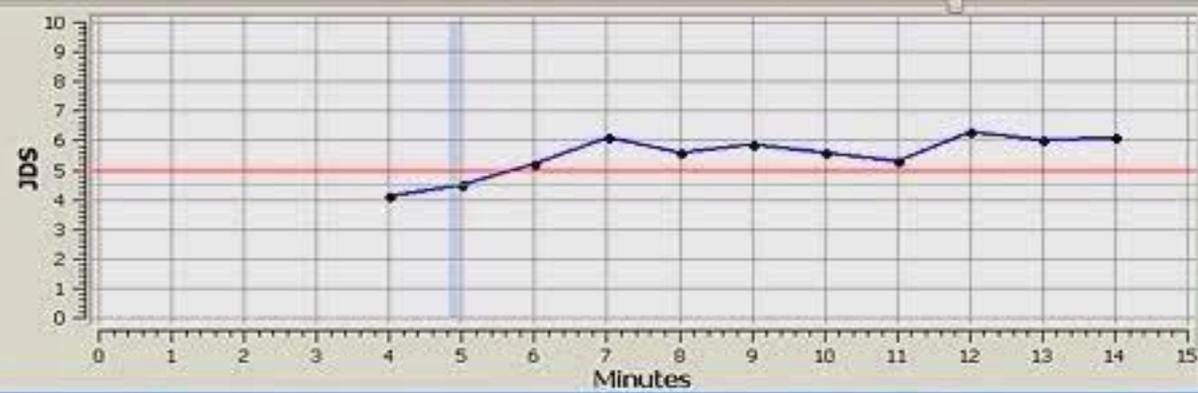
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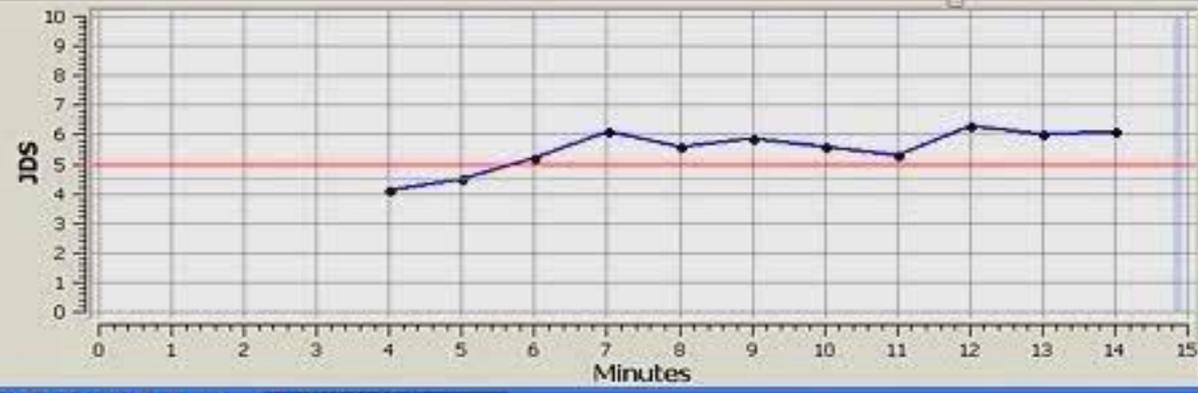
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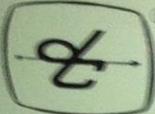
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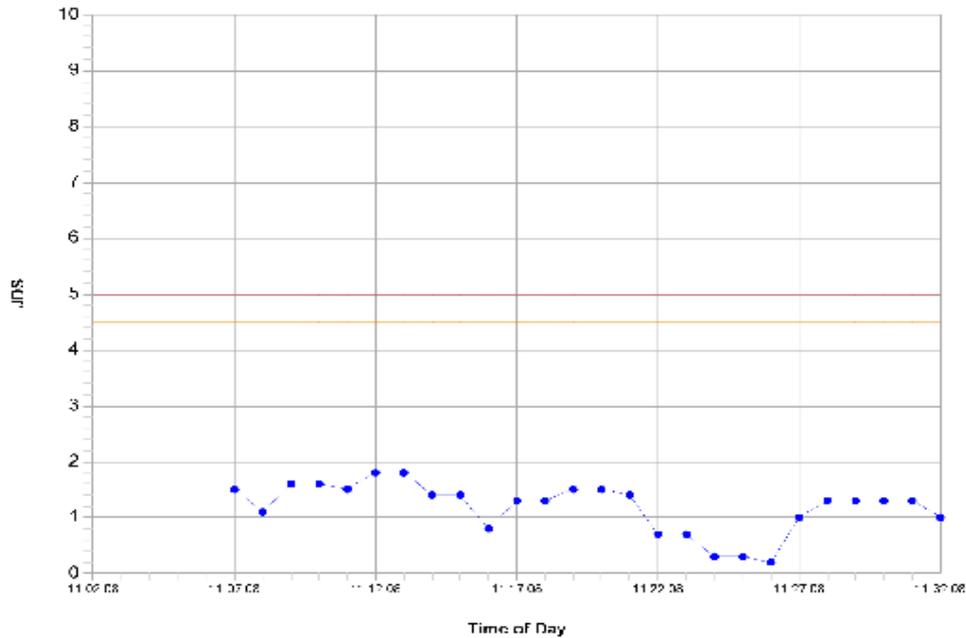
HSF

STOP CREW AIRPORT FOR TAKE OFF AND LANDING



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Gender:	Test Duration: 0:30:26	Configuration: 80109
ESS Score: 0	Glasses:	
KSS Score:	Response Pad:	
Conditions: FlyWales		

JDS Graph



Discussion

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