Working Hours and Fatigue in Aviation Maintenance
RAF Bentley Priory, *24/25 October*
Organized by the Royal Aeronautical Society HFG Engineering Maintenance Standing Group (EMSG)

Venue: RAF Bentley Priory

Programme:

Speaker	Topic
Cliff Edwards, Shell Aviation Ltd. (Chairman, RAeS HFG Engineering Maintenance Group (EMSG))	Welcome
Jim Gibbons, KLM-UK	Keynote Address
Mick Spencer, Qinetiq	Fatigue Theory
Anne Stuart, DTi	Application of the EU Working Time Directive to Aviation Maintenance
Bob Miles, HSE	Lessons from Offshore Operations
Evangelos Demosthenous, AEI	Fatigue: A European Industry Perspective
Drew Dawson, Univ. of South Australia	Fatigue and Risk Management
Simon Folkard, Swansea University	Working Hours of LAEs and Guidelines for Best Practice
Panel Discussion	Q & A
Simon Witts, Chairman UK SMS CAG	Safety Management Systems - Engineers' Working Hours
Open forum/ discussion facilitated by Bob Simmons, of BainesSimmons Consultants	Maintenance fatigue issues
Cliff Edwards, EMSG Chairman	Summary and close

Attendeees: see Attachment 1.

Keynote address - Jim Gibbons

Jim is Head of Engineering for KLM UK, Chairman of the UK OTG, a member of the SRG Research Advisory panel and serves on the IFA technical Committee. Jim has been in aircrat maintenance engineering since 1970, and has a particular interest in the subject of working hours and fatigue.

Whilst fatigue and its effects is nothing new to aviation, most previous presentations have been specific to flight deck and cabin staff. This conference is the first to address fatigue in the context of maintenance.

A number of years ago Human Factors was introduced into maintenance programs and one of the issues, sometimes contributing towards incidents and errors, was fatigue. Indeed CHIRP had highlighted concerns raised by engineers that fatigue, due to long hours, was affecting safety.

At the Flight Safety Foundation Conference in 1999, maintenance error and its contributory factors was discusse, as was the need to find solutions, in addition to the tools that already existed, to combat the apparent increase in maintenance errors. Whether something could be done about fatigue became a topic of conversation between the delegates during the social functions. The view from some people was that this subject was too difficult to deal with as it involved unions and labour agreements and any changes could effect workers income. A small group of people, including some members of the International Federation of Airworthiness, decided to grasp this nettle and actively looked for a way forward. Clearly scientific evidence was needed before a solution could be found. Therefore the aim was to put this subject on the conference circuit agenda to increase awareness of this uncharted issue.

Control of working hours in aviation maintenance is an area that had not received adequate attention over the years. Probably the main reason has been that majority of engineers like to work as many hours as possible for financial reasons, and certainly 12 hr shifts with a four days on four days off pattern is the shift preferred by the engineers. Not only has this working practice suited the staff but it has also suited the employer. Aircraft generally need maintenance out of normal working hours and two days over time can be generated for any unforeseen events without reducing the normal shift strength. Many engineers and employers also believe that performance is not impaired during this style of working. The scientific evidence presented at this conference will show that in reality this perception is flawed

At the same time that IFA started its work, the UKCAA sponsored Professor Simon Folkard from Swansea University to look into fatigue and working hours in aviation maintenance.

In the same year a small committee was drawn from the UKOTG and the EIMG to produce a code of

practice for UK industry. This code of practice recommend maximum working hours, rest periods and the need for risk assessment of individual fatigue when maximums were broached. A copy is attached in attachment 2.

It will be necessary to revisit this code of practice and consider the requirements of the Work Hours Directive especially when dealing with " night time " working and shift work. Presentations and discussions from this conference should enable a revised code of practice to be drawn up which will reflect up-to-date legislation, scientific knowledge, and industry views.

Theory of fatigue - Mick Spencer (Qinetiq)

Mick trained as a mathematician and has specialised for the last 15 years in sleep, circadian rhythms and fatigue. He is a leader of a team at the QinetiQ Centre for Human Sciences that conducts work into sleep and wakefulness, and the management of work and rest, in both civil and military environments. His team have developed a computerised fatigue model which highlights when flight crew are likely to be fatigued (he gave a paper on this topic at the RAeS fatigue conference the previous day). Further details of this work may be obtained from the CAA

It is necessary to know something about the scientific theory concerning fatigue and circadian rhythms, in order to better understand the problems and solutions proposed. Mick Spencer gave a brief grounding on the basic principles of fatigue. His slides are on the website (www.raes-hfg.com) and more detailed information can be found in most human factors textbooks for those who wish to explore this subject further.

Working Time Legislation - Anne Stuart, DTi

Anne Stuart is the Assistant Director of the Working Time policy team at the Department of Trade and Industry. Anne is responsible for implementing a new European Directive which will extend working time protections to the excluded sectors, which includes the aviation sector, by 1 August 2003 . Anne previously worked in Customs and Excise where she held a number of posts ranging from work involved in drugs policy to VAT inspections.
Also present, as a delegate, was Mark Allen, HSE Working Time Officer, who was able to answer some of the questions on the Working Time Directive on day 2.

A copy of Anne's presentation is on www.raes-hfg.com. Further information can be found on http://www2.dti.gov.uk/er/work_time_regs/wtr0.htm. Anne also provided a few copies of the DTi booklet "Your guide to the working time regulations" (DTi/Pub 6066/40K/5/02/RP) published in March 2000.

A summary of Anne's ppt presentation is included below:

<u>The Law:</u>
The WTD provides basic rights to the majority of workers
However, the WTD excluded certain sectors - road, rail, air, maritime & offshore oil and gas industries, as well as the activities of doctors in training - because of the complex needs of those industries.
These are now being brought into the WTD by means of the HAD & various Sectorial Directives (seafarers, road traansport and aviation)
The aviation maintenance sector isn't covered by the aviation directive - that's for aircrew - but by the HAD which will, essentially, give them the same obligations and entitlements as are in the WTD proper. These are:

- a limit of 48 hours a week (averaged over 17 week reference period) which a worker can be required to work, though workers can choose to work longer
- 4 weeks paid leave a year (note: 4 weeks does not necessarily mean 28 days, for part time workers; it is pro rata)
- rest breaks -
    - 11 consecutive hours rest in any 24 hour period
    - rest break if working longer than 6 hours (20 minutes in UK)
    - one day off each week
- night workers -
    - a limit of an average 8 hours in 24
    - right to receive free regular health assessments

<u>Flexibilities</u>
WTD has various flexibilities. Principle ones that are of interest here are:-

- need for continuity of service of production (eg. hospitals, media, utilities - but could also apply to aviation maintenance). The 'continuity of service' clause will probably be applicable to aviation maintenance
- forseeable surge of activity (eg. tourism, agriculture). The 'forseeable surge of activity' may or may not be applicable to aviation maintenance
- unforseeable emergencies (Force Majeur). 'Unforseeable emergencies' may well apply in aviation maintenance, but cannot be used as a reason not to comply on a regular/ frequent basis

In any of these cases, can disapply night work hours restriction, daily and weekly rest periods and in-work rest breaks.

Shiftworking: where there are changes of shift pattern and split shifts, can disapply daily and weekly rest but not in-work rest breaks. But if workers lose rest, they must be allowed an equivalent period of compensatory rest if at all possible.

Collective and workforce agreements can modify:-
- night work hours restriction, daily and weekly rest periods and in-work rest breaks
- reference period - can go up to 52 weeks if there are objective or technical reasons for extending it

Collective agreements are those between employers and trade unions, or between employers and employee groups (elected representatives who represent the workforce), or by vote. Such agreements can modify some issues. A local agreement is binding on all employees in that company. It may be possible to have different collective agreements for different bases/ outstations.

Opt-out
- The opt out clause is intended for individuals who wish to work more than 48 hours. This must be of their own volition, and not pressurised by management.
- The EU is reviewing the opt out clause; currently the UK is the only state which allows opt out.
- There is no opt out for night workers

Consultation:
Consultation document on the HAD is now on website http://www2.dti.gov.uk/er/work_time_regs/index.htm. The consultation period runs until 31 Jan 2003, and comments are welcome. Note: the HAD covers *all* the excluded sectors, not just maintenance.

Timetable for legislation:
Aim to lay legislation before Parliament by Easter 2003
Then still 3 months to prepare before implementation on 1 August 2003.

Enforcement
Limits (48 hr week, right to health assessment, night work, etc) - HSE
Entitlements (rest breaks, annual leave) - employment tribunals

Summary of discussions on 24/25 Oct
Some of the additional points arising from Anne's presentation, including some questions and answers, are summarised below:
- If a worker elects not to take their entitlements, it is their problem; the employer can't make them take their entitlements.
- For night workers, the WTD specifies an average of 8 hours work in a 24 hour period. Therefore four 12 hour night shifts followed by 2 days (or more) off is OK, but 5 12 hours nights followed by 3 days off is not. The popular 4 on, 4 off pattern is OK.
- There is currently a case in the European courts, the outcome of which will hopefully determine what is meant by "working time" and "call time".
- Traveling from home to work is not working time; traveling for the purposes of work is working time.
- The WTD is not clear about people who have to travel between different sites
- If there are two pieces of legislation regarding working hours which conflict, the more specific piece of legislation takes precedence (secretary's note: eg. ATC SCRATCHO - Uk scheme for the regulation of controllers' hours)
- If opting out, there is no requirements to ensure that an equivalent protection is in place (other than basic health and safety principles)
- The WTD is there to protect the individual worker, not the public (eg. airline passengers)

- There is no maximum duration for night work in terms of years.
- "Shiftwork" is the UK's interpretation of the EU WTD "patterns of work".
- The current provisions in the WTD are not up for consultation - only the HAD.

Shiftwork Offshore - Bob Miles, HSE

Bob is an Occupational Psychologist, but began career with an Engine/Airframe apprenticeship with BOAC, followed by a degree in Mechanical Engineering and period as Chartered Engineer working on the design of equipment for use offshore. Bob currently manages a £1m programme of Human Factors research for the Offshore Safety Division of the HSE. His particular interests include shiftwork, self-managing teams, motivation, and drug abuse in the workplace. Other roles include being Human Factors adviser to the UK railway industry confidential reporting system and member of the DTI National Advisory Committee on Human Factors.

Bob's paper and ppt are on www.raes-hfg.com therefore his presentation will not be minuted here. His presentation referenced work done by Kathy Parkes (Oxford University) on night workers and work done by Michelle Gibbs (Surrey University) on offshore workers, shiftworking, health and melatonin.

One of the points which Bob made is that whilst workers (whether in the offshore industry or wherever) have been happy to work long hours previously, this was Ok because there was still some slack in the system. Now, however, with recent economic constraints and reduced manning, this slack is disappearing and they are having to work harder for longer, and have found that long hours and tiredness are more of a problem than they used to be.

A question was asked as to whether there was enough HSE guidance on risk management/ assessment. The response was that this is currently under preparation and will hopefully be published soon.

Bob referred to a risk assessment checklist in his presentation, but noted that such tools tend to look at technical items only, and ought really to include 'people' issues in addition.

Differences between shiftworking in the offshore oil industry and shiftworking in aviation maintenance were briefly discussed, one of the key differences being that offshore workers don't have a great deal to do in their non-working time other than to sleep, whereas other shiftworkers have social and domestic commitments during their off duty time.

The offshore oil workers passport system mentioned by Bob was discussed. This is a swipe card, swiped at the heliport before flying to a rig, which keeps tabs on how many hours have been worked. It can be used on an EC wide basis. Unfortunately some major companies have failed to back/ mandate the scheme.

Fatigue; a European Industry Perspective - Evangelous Demosthenous, AEI

Vangelis is a maintenance engineer with Cyprus Airways, and Human Factors Coordinator with Aircraft Engineers International (AEI). He was a member of the JAA Maintenance Human Factors Working Group, and one of the contributors to NPA145-12 and the JAA Maintenance Human Factors Working Group report.

Vangelis' ppt is on www.raes-hfg.com. The work of the JAA Maintenance Human Factors Working Group, referred to in his presentation, can be found on www.jaa.nl (maintenance page). NPA145-12 will shortly be issued as amendment 5 to JAR145 (in Dec 2002 or Jan 2003). A copy is on www.raes-hfg.com (engineering maintenance standing group).

The main theme of Vangelis' presentation was that any regulatory requirements concerning duty time limitations ought really to be implemented via a JAR, rather than via EU law, since the former addressed a greater part of the industry. Without a JAR rule, operators may contract out their maintenance to no EU countries which do not have to abide by the UE WTD and therefore whose workforce may be less expensive and more flexible. The JAA MHFWG initially proposed a change to JAR145 to address fatigue, but were informed that this was the remit of the EU and therefore outside the remit of the JAA MHFWG, although there is a general reference within NPA12 to taking into account circadian rhythms and human performance at night when scheduling tasks and designing rosters.

Implementing fatigue risk management systems - Drew Dawson, University of South Australia

Drew Dawson is Professor of Psychology at the University of South Australia, and is Director of the Centre for Sleep Research. Over the last 6 years, Drew has led an industry based R&D program in the Australian rail industry, developing non-prescriptive evidence-based approaches to managing hours of service. Drew is also involved in similar research in the aviation industry, and has recently been involved

in discussions with Transport Canada on how to include fatigue management into a safety management programme. Some of Drew's work can be found on www.unisa.edu.au/sleep. His team has developed a fatigue model, details of which can be found on www.interdynamics.com/FAID.

Drew's ppt is on www.raes-hfg.com.

It proposes a fatigue management approach, as opposed to having stringent duty time regulation. Drew states that: "Historically, most regulators have tried to manage fatigue by prescribing how many hours an individual is allowed to work. In our view, good fatigue management is about regulating, measuring and managing the opportunity to obtain sufficient sleep" rather than prescribing the hours that an individual works"
Drew proposes that an organisation ought to be responsible for ensuring that an employee has adequate opportunity for sleep, using two simple rules:

- the start rule: Must obtain 5 hrs sleep in the 24hrs prior, and 12 hrs sleep in the 48hr prior to commencing work.the finish rule The period from wake-up to the end of shift should not exceed the amount of sleep obtained in the 48 hrs prior to commencing the shift

Having been given adequate opportunity to sleep, the individual is then responsible for ensuring that he takes advantage of this and does not abuse his non-work time.

Fatigue on its own isn't necessarily a problem; it all depends on what constitutes an acceptable level of risk. For instance, it would not be a problem for a photocopier operator to be fatigued, but it would be a problem for a maintenance engineer carrying out a safety critical tasks on a B747.

Drew suggested that each company be allowed to come up with its own fatigue management methodology, which would need to be approved by the regulator.

Recommendations for the Work Hours of UK Aircraft Maintenance Personnel Introduction by Dave Lewis, Deputy Chief Surveyor, AMSD, CAA

Dave explained the background to the CAA sponsored study on work hours of UK maintenance engineers that Simon has recently completed. Concerns had been aired via CHIRP that some engineers may be working excessive hours and this might be a potential or actual hazard. As a result, the CAA proposed a research project to (i) determine what hours engineers actually worked (and whether excessive hours were the norm or the exception) and (ii) develop best practice guidelines for working hours, based on scientific research. Simon Folkard, of Swansea University was contracted to do the work. The results have not yet been published as a CAA report, but have been published on the RAeS-HFG website as a scientific paper. The recommendations should not be interpreted as CAA requirements or policy at this stage.

Recommendations for the Work Hours of UK Aircraft Maintenance Personnel Simon Folkard, University of Wales, Swansea

Simon is a professor of psychology at Swansea University, and a leading world authority on the various problems associated with fatigue and safety. He set up the "Body Rhythms and Shiftwork" team at the MRC Applied Psychology Unit, and later established the Body Rhythms and Shiftwork Centre at Swansea University, of which he is the Director. He is the President of the Working Time Society, and Chairman of the ICOH Shiftwork Committee. Simon has advised many different industries on shiftwork issues, including the development of the scheme for the regulation of Air Traffic Controllers hours (SRATCHO) in the UK. More latterly, Simon has carried out some research on behalf of the CAA into work hours of aircraft maintenance engineers, which is the topic of his presentation.

Simon's ppt is on www.raes-hfg.com (maintenance fatigue conference page) and the full report is on http://www.raes-hfg.com/avmaint/reports/avmaint-fatigue-report.htm.

A question was raised as to why there weren't any aviation fatigue reports included in the research literature. Simon replied that whilst some research did exist, there was not enough detailed data (eg. a priori risk, shift systems in place at the time, etc) to allow for scientific analysis. It is necessary to look at research data scientifically in order to isolate variables; for example, one study of injury rates showed that the rate appeared to vary according to which nurse was on duty at the time!

Safety Management Systems; Engineers Working Hours - Simon Witts, BA CitiExpress

Simon Witts graduated from Queen Mary College, University of London, with a BSc (Honours) Degree in Avionics in 1979. On graduation, he joined Bristow Helicopters as a Project Engineer and completed a mini-apprenticeship prior to moving into flight test and development role as a Liaison Engineer leaving after three years to join Racal-Decca. In 1986, a move into the CAA Flight Test Department as a Flight System Test Engineer led to him spending three years flight testing a wide range of aircraft. He was promoted into the CAA Transport Aeroplane Group in 1990 and amongst other projects was responsible for the UK certification and introduction of the Boeing 777 for British Airways. In 1995, he

joined Air UK Engineering where he joined the Board as Engineering Director. In 1998, he took an offer of employment with British Regional Air Lines plc, where he became Technical Director, responsible for the Engineering and Maintenance of the fleet of British Regional and Manx Airlines. He was also a member of the Board of both Airlines. In May 2001, he was appointed General Manager Engineering for British Airways CitiExpress, he is a member of the Leadership Team of the company. Simon is Chair of the UK SMS CAG which has drafted a report on engineers' working times.

Simon's ppt is on www.raes-hfg. The UKSMSCAG report is still in draft and not yet available.

Simon talked briefly about the UK SMS CAG, and their previous incarnation as the UK HF CAG (when they produced the document "People, Practices and Procedures"). The group composition is as per Table 1, with group members representing various industry bodies as well as their own company.

Table 1. UK SMS CAG members	
Simon Witts	BA CitiExpress
Gerry Evans	Previously ALAE; now independent
Dave Hall/ Jim Done	CAA
Tony Bisson	independent
Jim Rainbow / John Saull	IFA
Geoff Ratcliffe	RAeS
Alan Simmons	RAeS/ AAIB
Peter Tait/ David Johnson	CHIRP
Gareth Cunningham	I
Cliff Edwards	BHAB/ Shell Aircraft
Sarah Havard	BAX Global
Peter Deacon	BMI
John Dunne	Airclaims
Phil Hall	Monarch Airlines Engineering
Tony Hines	Aeroskills Alliance

A question was asked as to whether the CAG has a Trades Union representative, the answer being only via the organisations which the members represent. The concern was that when addressing politically sensitive issues such as working time limits, it would be wise to involve the TUs in the discussions.

Bob Miles stated that he liked the approach adopted by the CAG, ie. risk management based. This would be in keeping with HSE policy. Bob was also supportive of the idea of having an agreed and coordinated industry standard.

It was suggested that it may be appropriate to bolt on the guidance produced by the CAG, to CAP712. CAP 712 states that you must carry out a risk assessment as part of an SMS; the UK SMS CAG paper tells you how you might do it for one of the risks - ie. fatigue.

One comment was that the document needed to expand slightly to include other issues potentially affecting fatigue, such as working conditions, positioning of engineers via cargo aircraft or scheduled services, etc. Simon agreed that whilst the document hints at such issues, it does not address them in detail.

Q&A session at the end of day 1

Q: Are some people naturally better adapted for shiftwork than others?
A (SF): Yes. Perhaps we ought to be selecting for adaptability to shiftwork? The tool mentioned in SF's presentation would not be sensitive enough to be used for selection purposes.

Q: How effective is fatigue management training?
A (SF): its effectiveness is of short duration, therefore the process needs to be continuous reeducation.

Q: Are shiftworkers more prone to poor health?
A (SF): a Swedish study indicates that after 20 years of shiftwork, the risk of heart disease is 3 times that of non-shiftworkers.

Q: Why don't we have more data about fatigue related accidents and incidents?
A (BM): people are loath to state that they were tired on an incident form, and even if they did, it tends to get lost in the narrative and not keyworded, or doesn't got forwarded to the regulator.

Comment: Engineers tend to be poor communicators and, therefore, not likely to own up to feeling fatigued. We have to accept this and work with it.

Comment: One delegate expressed scepticism about the practical implementation of sleep time optimisation

Comment: People aren't going to volunteer the information that they are tired (eg. at the weekend) because they would lose too much money.

Q: How can you test for tiredness?
A (DD): There are various means, but one system used by BHP is a performance assessment task based on a short (90 sec) video game. It can show a performance decrement which may be due to fatigue. It is non jeopardy - ie. failures aren't punished. However, the USA have used this test as a 'policeman' - which doesn't work.

Comment: The MESH system failed in Company B because it took too long to complete. A short task would be better.

Q: Will the WTD opt out clause allow employers to not comply with the WTD?
A (MA): There is consultation currently going on concerning the opt-out clause; many questions are being asked; it isn't clear whether it will stay or go. There is some work being done at Cambridge University on this.

Comment (BM): The WTD is not evidence based in terms of safety. HSE have to be evidence based and people have to demonstrate that they are managing safety. Simple compliance with the WTD is therefore not enough. The opt out clause will not protect an organisation against HSE prosecution.

Comment: Prescriptive legislation such as the WTD is a step backwards, especially when not even based on hard science.

Comment (SF): There is a lot of pressure on mainland Europe to reduce the 48 hour limit. It is possible the future changes of the WTD may reflect these wishes.

Q: Do studies on light level related incidents help us with the fatigue problem?
A (BM): There is some evidence to suggest the problem is greater in the summer, possibly because it is more difficult to sleep with light mornings and evenings.

Q: Is too much sleep dangerous?
A (SF): Not as such, but sleep inertia (ie. grogginess shortly after waking) can be a problem after naps longer than 30 minutes.

Comment: There was a case in Australia where an ambulance crew, on stand-by, were woken up with a call, and wrote down the wrong address (someone died as a result). Napping was then banned as a knee-jerk reaction. It took several years for napping to be allowed again (and then, only on the basis of one person at a time)

Q: is there any evidence to show that napping is more beneficial to those nationalities used to it (eg. Mediterranean cultures who have siestas)?
A: No.

Comment (BM): Regulatory oversight on fatigue issues is currently complex: if an engineer's error, when fatigued, results in an injury to him, the HSE investigate; if the error results in a place crash, the AAIB investigate; if the engineer crashes his car on the way home from work, the police investigate. We are outcome focused, not cause focused.

Q: Did the Folkard study split line & base maintenance?
A (SF): No; the data did not make this possible to do.

Comment: Adjustment of circadian rhythms is easier when people have nothing to do but sleep or work.

Comment: People who work permanent nights tend to do so because it suits them.

Q: Is choice of shift a seniority based issue?
A: No (not in UK)

Comment: If people are consulted on something (eg. shift patterns) their performanxce tends to be better.

Workshop discussion - facilitated by Bob Simmons, BainesSimmons consultants

<u>Is there a problem</u> with fatigue in aviation maintenance?

About 60 % think yes.

Where?

- AOG situation, unplanned work. It tends to be the people who have just finished their shift who volunteer to stay on (for the overtime) and travel to the AOG. (these are they very people who should not be doing the work, as they are likely to be fatigued)
- ramp maintenance
- casualty maintenance
- night work
- handovers
- contract staff
- moonlighting/ secondary employment
- employees with long travelling distances/ times
- overstretched support staff, leading to poor planning and a knock-on effect for maintenance staff

It is always the same few engineers who always volunteer to do overtime - (this could be a problem if they don't allow themselves adequate recovery time).
Suggestion - if overtime was at flat rate this might discourage people who do too much overtime for the wrong reasons. However, some disagreed with this argument. One person stated that working extra hours isn't always driven by money.

It is important to plan properly, although this is difficult when you don't have enough staff.

Traditionally, the culture is that engineering will always cope somehow. What is needed is to get the organisation to accept that aircraft will need to be cancelled if necessary (eg. if there are not enough engineers) instead of relying upon engineering to stretch to cope. They accept it when flight crew or even cabin crew are out of hours and flights have to be cancelled as a result - why not engineering. This needs to be a culture change at the top level of an organisation.

Secondary employment may be a problem. One manager requires all his engineers to inform him if they have secondary employment, but suspects that they don't always let him know.
One manager had to change the personal contracts and fire people who were moonlighting.
The suggested solution is to instill more personal responsibility in individuals such that they appreciate the irresponsibility of moonlighting.

Contract staff are a big a problem. One example was cited of contract staff working with two different companies, doing back-to-back 12 hour shifts!
Bob Miles suggested that it would be inappropriate to have too many contract staff - the majority of the workforce should be permanent employees.

There is a dilemma in the industry, on the one hand disapproving of moonlighting but on the other hand wanting people to work long overtime.

Evidence?

Senior managers ask for evidence of the existence of a problem. In Company M, they haven't seen much evidence of fatigue as a problem from MEDA reports. However, the HSEC 'safety health' tool did identify fatigue as a problem (although not a major one).

Fatigue rarely comes up as an issue in an incident, because people don't report it as a problem.

Company M have plotted errors against night and day (taking into account amounts of work); there are more at night.

In the 3 main, often cited, UK maintenance error accidents/ incidents investigated by the AAIB, there were indications to suggest that fatigue might have been a problem (eg. errors occurred at night, at circadian rhythm lows, etc) but no actual evidence of fatigue.

Responsibility of organisations to manage fatigue?

It should be a shared responsibility. AN47 goes some way towards saying this, but not far enough.

One organisation present is managing fatigue by self-imposing a 60 hours per week limit.

How do you establish whether someone is fatigued or not?

In order to manager, you need to measure.

None of the organisations represented appeared to be measuring fatigue in any way.

It is very difficult to measure.

Is there a relationship between fatigue and casual sickness rate? If so, you might be able to use days off sick (discounting longer term illness) as a measurement.

Does the HSEC tool measure fatigue? Yes, to a certain extent.

People differ. One person may be fatigued after working 24 hours; another may not. People should not be pressured to work longer than they are happy to do so.

The issue of personal responsibility was discussed, how to convince engineers to speak up when they feel too tired to work safely, and how to support them when they do. Staff need to believe that they will be supported by the organisation if they do speak up, and not fired! It is vital to get the culture right.
The army place a lot of emphasis on personal responsibility and are very supportive of engineers who state that they cannot work due to fatigue.
Training in personal responsibility is needed, but such training needs to include management and, if third part maintenance, the operator/ employer.
It was suggested that whilst training might help, only time and culture change would be successful in the long run (like tolerance for drink-driving). Training can't force the change, only encourage it.

Comment: with manpower shortages, engineers are reluctant to leave an unfinished job at the end of a shift in case there are not enough (appropriately qualified) people on the following (day) shift to finish it off.

How do you measure fatigue with someone who, on paper, has worked reasonable hours and has plenty of opportunity to rest, but who is so engrossed with work problems that they do not get adequate sleep because they have work going through their head all night? (several people agreed that this is a problem). Answer - you have to get to the root of the problem - why they are worrying- and address that.

What is the correlation between fatigue and stress? They have similar symptoms. How do you know whether someone is stressed or fatigued?
Bob Miles - a root cause analysis in the oil industry indicated that there is a 75% overlap in the causes between stress and fatigue; fix the common causes and you fix both problems/ symptoms.

<u>Human factors training</u>

There was a long discussion about MHF training, both in the context of fatigue and personal responsibility, and in more general terms.

The type of training is important. Military training is good, with videos, posters, etc.; civil aviation training is not so good.
More resources are needed for small organisations who wish to do training. The CAA could help here.

Why not pool military and civil resources in training?

Comment that training is only effective if it is part of a systematic, whole programme; it is not effective if done in isolation.

General agreement that training forms part of the solution.

<u>EU WTD</u>

Company K - we can work with this with no problems.

Comment - it is a useful trigger to get board members to do/support things!

Company F - it will have a negative effect. People have better conditions now, and they will lose these when the WTD comes into force because management will work staff up to the limits.

<u>Should JAR145 be developed to encompass fatigue?</u>

yes, it should be the main driver.

The planning requirement needs beefing up; planning could be improved.

it is easier to get things through the board if legislative.

It would be better to use JAROPS rather than JAR145. Agreed.

SMS is owned by the operator - isn't this the place to put it?

Is best practice guidance the way to go?

(Little response)

Guidance needs to include personal responsibility. This is covered to a certain extent by AN47, but this is UK only - why not put it in JAR66? Comment - JAR66 doesn't cover everyone therefore this isn't the appropriate place.
(note: personal responsibility will be covered in the JAR145 amendment 5 HF syllabus as a training issue)

Is regulation the way to go?

Some say yes; others say no.

Bob Miles - regulation is a good way of getting rid of the cowboys.

Comment - regulation is one way of getting equivalence between engineers and flight crew - after all, the consequences of error when fatigued can be the same.

Comment: regulation doesn't always equate to best practice

Who would prefer prescriptive regulation? 10 to 20 raised their hands
Who would prefer best practice? 20 to 40 raised their hands.

Comment: you still need to specify the minimum acceptable standard, even with best practice.

Comment: the prescriptive requirements can provide the framework; the best practice standards can provide the detail.

Q: Won't the WTD provide the regulatory minimum? Why is any further regulatory requirement needed?

Other issues

HF training was discussed at some length.

Comment (RAF): they don't have a moonlighting problem. They have good control of hours/ shifts worked.

Comment (Navy): Senior NCOs tend to have a good understanding of their junior staff and their capacity, capability. etc.

Comment (Army): they don't do formal HF training.

Comment (DASC): The RAF does HF training, and is about to start ground crew alertness training.

Comment: prioritisation planning is crucial; we need to plan earlier to anticipate problems which might lead to fatigue.

Comment: company F rarranged their planning to better fit in with arrivals schedules. This helped.

Comment: DD's risk management approach is a good idea.

Comment: Transport Canada are doing a lot of work on risk assessment (and fatigue).

Comment: Company B has done some rough classification of types of work and potential risk level (eg. servicing = low risk; maintenance = moderate risk; vital points = higher risk) but have not related this to fatigue (but could do so).

Comment: Company B have looked at low capacity planning.

Comment: The idea of categorising risk levels is good, but it would appear to be aircraft focussed and would need to take into account the human as well.

Comment (BM): Need to take into account occupational health and safety as well as aviation safety, when looking at fatigue (eg. long term monitoring of shiftworkers)

Comment: In a small organisation there is not the manpower to have a dedicated person to do HF training/ fatigue monitoring/ etc. The CAA or CAG could help here.

Comment: the same principles of safety management apply to both large and small orgnisations.
Response: but the cost is relatively more significant for smaller organisations.

Comment: we should be looking at the whole process, from manufacturing to ops.

Comment: Newer aircraft are better designed, but there are still many older aircraft out there which are not.

Comment: the aircraft manufacturers are interested in the results of the MEDA data sharing project

Summary

See Cliff Edwards summary notes,on www.raes-hfg.com.

Fatigue is an issue but should not be treated disproportionately

It needs a shared responsibility contract, and embedded into the company culture

There should be a duty of care to manage fatigue

Some legislation would be useful, possibly via JAROPS

The WTD will set a minimum

We should be looking at best practice, not a minimum

We need guidance/ code of practice

Risk asssessments need to be done; SMS can offer a methodology

Training on fatigue management and fatigue awareness isnecessary, but as part of a complete process