

1 MARCH 17, 2004

2 P R O C E E D I N G S

3 CONTINUING...

4 THE BAILIFF: All rise.

5 (Jury returned into open court.)

6 THE COURT: You may be seated.

7 Mr. ~~XXXXXXXX~~, call your next witness.

8 MR. ~~XXXXXXXX~~: Your Honor, the defense calls Dr.
9 Martin Moore-Ede.

10 THE COURT: Would you raise your right hand?

11 (Witness sworn by the Court.)

12 THE COURT: You may take the stand.

13 THE WITNESS: Thank you, Your Honor.

14 DR. MARTIN MOORE-EDE

15 having been previously sworn by the Court, testified on
16 his oath as follows:

17 DIRECT EXAMINATION

18 BY MR. ~~XXXXXXXX~~:

19 Q Good morning, Doctor. Could you introduce
20 yourself to the jury?

21 A Yes. Good morning. My name is Dr. Martin
22 Moore-Ede.

23 Q And where are you from originally?

24 A Originally from London, England.

25 Q And you have lived in the United States for a

1 while?

2 A Yes. I have. I have actually lived in the
3 United States almost 30 years at this point.

4 Q Where do you presently live?

5 A I live in Boston, Massachusetts.

6 Q And originally did we have you scheduled to be
7 here yesterday?

8 A You did indeed, yes.

9 Q And did you have travel and everything set up
10 for that?

11 A Yes. I was at the airport ready to come.

12 Q And did I through some other people advise you
13 that we were having trouble getting a jury and to revise
14 that one day?

15 A Yes, you did. I went back home again.

16 Q In any event, what do you do for a living?

17 A I am the CEO of a consulting firm, a research
18 and consulting firm that specializes in the problems of
19 fatigue in industries that run 24-7, whenever people are
20 working shift work around the clock. We specialize in
21 helping identify that problem and helping reduce the risk
22 of cause and effect type accidents in shift work and
23 around-the-clock type operations like airlines and
24 railroads and police forces and so forth.

25 Q And what kind of background do you have to hold

1 that position?

2 A Well, my training was originally in medicine,
3 and I am qualified in medicine in England. I then went
4 and started as a surgeon in a surgical career and
5 training and found I was working 36 hour shifts in the
6 surgery and training on my feet for 36 hours and then off
7 for 12 and back in for 36. And needless to say, after a
8 week or a few days of that or a week of that I got
9 extremely fatigued. I was nodding off in the operating
10 room and falling asleep at inopportune times. And I
11 eventually got interested in the issue of fatigue at that
12 point.

13 And I went to graduate school eventually and
14 did a Ph.D. at Harvard on the whole issue of circadian
15 rhythms and sleep and fatigue. In other words, what
16 makes you sleep at night and what makes you awake
17 normally during the daytime. And that is my specialty.

18 Q You said that you were suffering from fatigue
19 from these long shifts at the hospital. Was that in
20 England?

21 A That was -- actually my training was over here.
22 It was actually in Canada where I did my surgical
23 internship. I was a surgical intern, much like you see
24 on ER, working those extended hours.

25 Q Is that similar to, like, our medical residency

1 program in the United States where the young doctors
2 become residents in the hospital?

3 A Exactly the same thing.

4 Q Now, you said, I noticed that I was suffering
5 from fatigue. What were some of the things that you
6 noticed about yourself that caused you to --

7 MS. SICA: Objection. This is irrelevant.

8 THE COURT: Sustained.

9 Q (By Mr. Milner) You said you went over and did
10 a Ph.D. at Harvard. What exactly is your educational
11 background?

12 A My Ph.D. was in Physiology, which is the study
13 of the human body and circadian factors, which is the
14 regulation of the body cycles, the day and night cycles.
15 And I completed my Ph.D. in 1964 at Harvard Medical
16 School.

17 MR. [REDACTED]: May I approach the witness, Your
18 Honor?

19 THE COURT: You may.

20 Q Let me show you what is marked as Defense
21 Exhibit 1. Can you identify this for the jury?

22 A Yes. That is my curriculum vitae and some of
23 my publications.

24 Q Does this give a very in-depth summary of your
25 educational and professional background as well as

1 publications and books and articles?

2 A Yes, it does.

3 Q How many books do you have published in this
4 subject area?

5 A I have ten books published.

6 Q Have you ever written any peer reviewed
7 articles?

8 A Yes. I have written over 140 peer reviewed
9 articles.

10 Q And does this literally list the books which
11 have been published over the last ten years as well as
12 the articles which have been published over the last ten
13 years?

14 A Yes. It lists the most recent ones of those
15 articles and books.

16 Q And have you -- are there some articles -- this
17 goes up through 139?

18 A That is a little bit out of date. There is a
19 couple of more since then.

20 MR. ~~XXXXXXXXXX~~ In any event, we would move to
21 admit Defendant's Exhibit 1.

22 MS. SICA: No objection.

23 THE COURT: It's admitted.

24 Q (By Mr. Milner) Let me go through this. You
25 said: I have done a lot of research; I have written a lot

1 of articles. And, obviously you know this is a DWI
2 trial, correct?

3 A I do, yes.

4 Q I mean, has it been the focus of your career to
5 study DWI or anything to do with DWI?

6 A Not specifically. The focus has been on
7 fatigue itself and sleep deprivation and fatigue.

8 Q In that regard -- and you have been doing this
9 for -- obviously it's been years, and you have written a
10 lot of articles. Have you done an extensive amount of
11 research in the way sleep deprivation affects the body?

12 A Yes, I have.

13 Q Who sponsored it? I mean, this kind of
14 research takes a lot of time. Who sponsors these? I
15 mean, who are the people that are paying you to go out
16 and do the research that you do?

17 MS. SICA: Objection. That is irrelevant.

18 THE COURT: Sustained.

19 MR. ████████: May we approach on this?

20 THE COURT: You may.

21 (Off-the-record discussion.)

22 Q (By Mr. ████████) Dr. Moore-Ede, who sponsored
23 you? Who's hiring you to do this?

24 A Right. The research has been sponsored by
25 various government agencies, including NASA, the United

1 States Air Force, the Army, the National Institute of
2 Health and the National Science Foundation, as well as a
3 number of companies who have got to run 24-7 operations
4 and are very interested about the issue of fatigue.

5 Q Does the issue of fatigue cause losses to these
6 government agencies like NASA and the United States Air
7 Force and all of these big companies that have people
8 working around the clock?

9 A Yes, it does. It's a big issue for the Air
10 Force and for NASA and the whole problem of jet lag when
11 people get extremely fatigued because they are flying
12 across time zones. We did a big project for the Air
13 Force that had to do with jet lag. And it's an issue for
14 companies that run 24-7 or run around the clock because
15 there are more accidents in the area after midnight.
16 People are more likely to fall asleep at the wheel or at
17 the control office. It's a very big concern. In fact,
18 it's a problem everywhere.

19 We have moved our world from a nine-to-five day
20 to a 24-7 day, where things just run nonstop around the
21 clock. And it's a huge issue in the more global economy.

22 Q And have we hired you to do a complete analysis
23 of the case involving ~~John~~ ~~_____~~?

24 A Yes, you have.

25 Q And if we talked about -- you said the safety

1 States Air Force, the Army, the National Institute of
2 Health and the National Science Foundation, as well as a
3 number of companies who have got to run 24-7 operations
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21 clock. And it's a huge issue in the more global economy.

22 Q And have we hired you to do a complete analysis
23 of the case involving ~~John~~ ~~_____~~?

24 A Yes, you have.

25 Q And if we talked about -- you said the safety

1 and people driving. If we talk about how sleep
2 deprivation and fatigue relates to driving, you said it's
3 a safety issue. I mean, is it a minor safety issue where
4 we get a few fender-benders as a result of this, or how
5 significant is the safety concern related specifically to
6 sleep deprivation and driving?

7 A It's one of the major causes of accidents,
8 particularly serious accidents behind the wheel. There
9 are an estimate of the fatality accidents on the freeways
10 up to 40 or 50 percent of various accidents are related
11 to fatigued individuals. In fact, it's been a more
12 important problem than alcohol and many issues. In fact,
13 in the trucking industry, as an example, a fatigued
14 driver is a much more common cause of an accident than a
15 driver that is intoxicated.

16 And this has been a growing awareness that this
17 is a huge problem. In fact, something like 40 percent of
18 Americans admit to being extremely sleepy behind the
19 wheel and occasionally nodding off behind the wheel.
20 It's a pretty common problem and a pretty dangerous one.

21 Q Have you prepared a power point presentation to
22 start off going through step-by-step, A, how this
23 generally works and how the investigation relates to ~~_____~~

24 ~~_____~~
25 A Yes, I have.

1 People normally assume we sleep at night
2 because it's dark or because that is just a natural way
3 of doing it. In fact, we sleep at night because our
4 brains are wired that way. Ever since a million years
5 ago when we were running around as cavemen -- or our
6 ancestors were -- we actually slept at night because we
7 humans have a poor sense of vision at night and poor
8 sense of smell. We are just not very good survivors in
9 the world. Those that wandered around got eaten. And it
10 so happened and evolved that this biological clock in the
11 brain -- it's labeled there. But it's a little clock
12 just like the pacemaker in your heart.

13 Only this is the pacemaker that makes you sleep
14 at night time and awake during the daytime. So, we are
15 on a regular schedule that is synchronized to the world
16 we are in. It synchronizes the todays and tonights and
17 keeps us in step.

18 Q Okay. What is this chart showing us here?
19 Explain this to us.

20 A Yes. This chart shows the pattern over a
21 typical -- a typical nine-to-five schedule. So, just
22 take a typical pattern of someone who might be working
23 from 9:00 to 5:00 during the daytime, which is the blue
24 bars here. And here is Monday, Tuesday, Wednesday,
25 Thursday, Friday of the work week. Here is a weekend of

1 the Saturday and Sunday. Just a Saturday and Sunday
2 weekend here. And then here is the next week.

3 As you see, a typical person might go to bed,
4 let's say, at 11:00 p.m. and wake at 7:00 and get up,
5 shower, have breakfast. Commute is the green. Then go
6 to work and then commute back home and have the evening
7 off. So, that would be just a totally basic schedule.

8 Then, of course, on the weekend we tend to stay
9 up a little bit later often on Friday and Saturday nights
10 and sleep in a little bit later. Most people do, or many
11 people do on Saturdays and Sunday mornings. And then we
12 go back to the workday schedule.

13 So, it's just a way of introducing how when we
14 analyze sleep wave patterns, how we clock them, and how I
15 have. Basically, what we are looking at is the time of
16 day here from midnight to midnight, and here is each
17 successive day shown under the others. So, you can see
18 the sort of progression of time.

19 Normally we live a very regular life. Our
20 bodies are designed to sleep regularly at the same time
21 and designed to work at the same time every day. That
22 is, you know, a pattern that used to be much more common
23 than it is today.

24 Q Is the pattern of sleep -- is that important as
25 it relates to fatigue?

1 A Yes, it is. What actually is very important to
2 healthy sleep is sleeping at the same time, in the same
3 bed, and in the same schedule. In fact, that enables the
4 sleep patterns to get stabilized, and enables you to get
5 the most restful sleep.

6 Where you get in trouble is where you're
7 staying up at night or trying to sleep during the daytime
8 or shifting around a lot. So, that is when you get sort
9 of chronic fatigue and exhaustion. Too often people --
10 because of family responsibilities, because of job
11 responsibilities, are forced out of this normal behavior,
12 and that is why fatigue is a problem in the world today.

13 Q Okay. What does this show us here?

14 A Basically, the other side of sleep is how alert
15 you are. And what we measure is we measure ranging from
16 a range of alertness, which means your brain is fully
17 functioning. You're not falling asleep. You're paying
18 attention. As you are right now. Fully alert.

19 Then it's way down to being extremely sleepy,
20 where you can't keep your eyes open and you fall asleep
21 in your chair. Normally over the course of day and night
22 we vary. So, we might be there. There is certain times
23 of the day that we are much more alert, and other times
24 of the day, like after lunch -- I am glad I am not doing
25 this immediately after lunch. It's a bit more

1 challenging to keep people's eyes open.

2 The problem is when you drop below a certain
3 level you get into what is called fatigue impairment.
4 That is where you're so drowsy that, in fact, you are
5 more likely to make mistakes, have accidents, forget your
6 own name. When I was a doctor I wrote prescriptions I
7 couldn't make sense of the next day when I was down in
8 this state.

9 So, this is the danger zone, and that is why we
10 mark it as red.

11 Q Is that a measurable amount? When we say
12 fatigue impairment below a certain range, is there a
13 quantitative measurement where you can say, Below a
14 certain level this person is going to suffer from
15 impairment?

16 A There absolutely is. And the simplest test we
17 can do is take anybody and we have a bedroom, just next
18 door. And we just take you to the bedroom, lay you down,
19 switch out the lights, and see how long it is before you
20 actually sleep.

21 So, if you're wide awake, like you might be
22 now, you just lay there with your eyes open. You just
23 can't fall asleep. But, on the other hand, if you're
24 drowsy, your head hits the pillow and you immediately
25 fall asleep.

1 On the next slide we actually show how they
2 measure it. It's called the sleep test. That varies
3 between falling asleep within a minute, less than a
4 minute of falling asleep, not falling asleep at all in 20
5 minutes. So, we have a variety between very alert and
6 asleep. We have a scale of zero minutes to 20 minutes.
7 And it's a way of measuring how sleepy you are.

8 So, in other words, we can take any one of the
9 jurors right now, and actually test how sleepy you are
10 and put a number to it.

11 Q How could you do it in a real human being? In
12 a human world, how do you test somebody?

13 A How we actually do it is we glue some wires to
14 the head of -- or to the scalp. And we can measure brain
15 waves on a electroencephalogram or EEG. And with that
16 EEG we can actually -- we can monitor the EEG's. We can
17 see the moment a person drops from being awake to asleep.
18 We can actually count the minutes it takes to fall
19 asleep. So, we can actually measure it by wiring you up
20 in the lab. It's a bit like, you know, a test where
21 they put these wires into your head and plug you into a
22 machine and you can record it.

23 Q How may times have you done that?

24 A Thousands of times in the course of 25 years of
25 research.

1 Q Is this well recognized research?

2 A It is. It is universally recognized. There
3 are ten thousands or many thousands of researchers in
4 Universities around the world doing this type of
5 research. There is an annual meeting of the Sleep
6 Society, which has ten thousand attendees to it. So,
7 it's a very well established body of science, a very
8 important body of science about sleep and the deprivation
9 and the effects of fatigue.

10 Q Now, what is this second part of the graph
11 showing us?

12 A Well, the left side and the right side, first
13 of all, show what the effects of having too little sleep
14 are on fatigue. So, if we take this measure, we first
15 look at the left side of this and we look at people who
16 have eight hours sleep the previous night.

17 In others words, if you have a guy, eight hours
18 sleep, your age, the alertness is going to be pretty
19 high. It's going to go up and down, but it's going to be
20 pretty high.

21 But, if indeed, last night you have seven hours
22 or six hours or even five -- there is not much change in
23 one night. But to go below four hours, you're just
24 basically going to start losing it. So, people who get
25 four hours or three hours of sleep or less get extremely

1 impaired in just one night.

2 The right hand side of the slide shows that
3 even if you're up here getting five hours sleep or six
4 hours sleep, and it's one night you are okay.

5 If you do that night after night, it's a
6 cumulative effect. We have something that we might call
7 a sleep banking account, whereby when we occasionally get
8 into sleep depravity we gradually lose the amount of
9 sleep in the reserves. And as a result, we are more
10 vulnerable and get sleepier and sleepier during the week.
11 So, this might represent a tough week. On Monday you're
12 okay, but Tuesday you're going downhill. And by Friday
13 you're really walking around like a zombie.

14 So, that might represent this.

15 Again, this is all scientifically tested by
16 measuring hundreds of people to find out how many minutes
17 it takes them to slip into a sleep under very controlled
18 circumstances.

19 Q Does this show us, like, if I go one night and
20 I had to work really late, the next day I'm a little
21 behind. But then I make up for it the next day, and
22 after that I'm okay.

23 A Eventually, absolutely. You can catch up. A
24 good nights sleep or simply a couple of good nights sleep
25 brings you right back. So, like a weekend -- if you get

