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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of:)
PRIVATE FUEL STORAGE, LLC,) Docket No. 72-22
(Independent Spent Fuel) ASLBP No.
Storage Installation) 97-732-02-ISFSI
)

U. S. Nuclear Regulatory Commission
Utah State Capitol
Salt Lake City, Utah 84114

Volume II of April 12, 2002, EVENING SESSION

On Friday, April 12, 2002 the above-entitled matter
came on for hearing, pursuant to notice, before:

MICHAEL C. FARRAR, CHAIRMAN
Administrative Judge
U. S. Nuclear Regulatory Commission

DR. JERRY R. KLINE
Administrative Judge
Atomic Safety & Licensing Board Panel

DR. PETER S. LAM
Administrative Judge
Atomic Safety & Licensing Board Panel

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and Amitava Ghosh

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Friday Evening, April 12, 2002

P R O C E E D I N G S

JUDGE FARRAR: Then we have a few questions from the Board. Dr. Lam will go first.

JUDGE LAM: Dr. Campe, Dr. Ghosh, let me address my questions to you first, Dr. Campe. You are one of the most experienced of the experts on the Agency staff on aircraft crash, if not the most experienced. Am I correct?

DR. CAMPE: I don't know that for sure. There may be some staff people in our office of research that could have in-depth experience in this area, as well.

JUDGE LAM: By my remark I meant you had participated in the writing of the NUREG 0800 and you also stated that you have reviewed practically every application of all the power plants regarding aircraft crash.

DR. CAMPE: Yes, sir.

JUDGE LAM: May I ask you, Dr. Campe, in your career have you ever seen an application that came in regarding aircraft crashes that would deviate from the usage of the four-factor formula

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1 in NUREG 0800? By "deviation" I meant not using
2 the four-factor formula in a significant way.

3 DR. CAMPE: I believe that is true, that
4 there have been cases where -- I wouldn't call it a
5 matter so much of deviation but of never having
6 used it. Notable -- perhaps a trivial but a
7 notable example is that in some sites, when they
8 were proposed for constructing a facility, almost
9 by inspection, by reviewing the area, airports and
10 air corridors and air activities, one could just,
11 on a qualitative argument basis, conclude that
12 there was no significant hazard. So there would be
13 an example where there was no formal calculation
14 done. This was more of a practice, perhaps, in the
15 early siting days, early '70s, when nuclear power
16 plants were first being put on a docket for
17 construction and operation.

18 JUDGE LAM: Now let me --

19 DR. CAMPE: And then the only other
20 example that I can come up with is where the
21 analysis, and I don't necessarily recall the
22 details, but the analysis captured the basic
23 elements that shaped the probability; namely the
24 frequency of flights, the crash rate, the size of
25 the target, and things of this nature. And the

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1 calculation is made perhaps not necessarily in the
2 same format that is presented or summarized in
3 NUREG 0800.

4 A notable example of that, and a very
5 simple one to illustrate, if we recall the factor N
6 in the formula where N stands for the number of
7 flights per year, if in a particular site situation
8 it is well-known, let's say, that only one certain
9 type of aircraft goes back and forth along some
10 specified corridor, then typically in the analysis
11 one directly, almost, proceeds to calling out
12 flight data, flight frequency data for that type of
13 aircraft, dismissing other aircraft as being
14 nonapplicable because they are never there. This
15 could be done formally by taking N and applying it
16 in some formal factor that accounts for only
17 aircraft of that particular time, as a fraction of
18 total flights. But that's not necessarily -- it is
19 not necessary. Sometimes it is just done directly
20 by explaining that these are the only aircraft in
21 the area. So these are the kinds of things that
22 can occur as far as how one approaches the
23 analysis.

24 JUDGE LAM: Yes, indeed. But I would
25 not call that deviation because within the NUREG

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1 0800 methodology you were very specific in telling
2 the user meaningful site-specific data should be
3 applied, by which I mean in your four-factor
4 formula the crash data should be only applicable to
5 the aircraft that's flying over the corridor. If
6 only 727s fly over it, one should not use 747s.
7 The number N, number of flights, should equally be
8 that specific. If the flight doesn't fly over the
9 corridor, why use it? And so is the area of the
10 target, and so is the width of the flight path. Am
11 I correct to assume that, Dr. Campe?

12 DR. CAMPE: That is correct. And I was
13 only showing one example. Another example is where
14 an analysis is made to deliberately exclude certain
15 types of aircraft by virtue of what they can or
16 cannot do to the facility. And there you go into a
17 structural analysis which, again, departs from the
18 four-factor formula. It's an adjunct to the
19 analysis and methodology.

20 JUDGE LAM: Yes, indeed. I also
21 understand in the NUREG 0800 document, it very
22 specifically said one method to compute the impact
23 probability is the four-factor formula which would
24 imply or state explicitly there are other methods.
25 Right?

1 DR. CAMPE: Absolutely. And I have many
2 times, in other review areas I have been in, not
3 aircraft hazards, had to face totally different
4 analyses that had no resemblance to what was in the
5 standard review plan. And we proceed, then, with
6 doing the review of what is submitted to us.

7 JUDGE LAM: But I thought in your
8 earlier answer to my question, you have not seen
9 any significant departure from the four-factor
10 formula.

11 DR. CAMPE: Not in the aircraft area. I
12 have done other areas of review with respect to
13 other Tornado missiles, for example, is another
14 area of review and so on.

15 JUDGE LAM: Yes. But my answer was
16 really limited to the aircraft area. So let the
17 record reflect there has not been any significant
18 departure from the four-factor formula; is that
19 correct, Dr. Campe?

20 DR. CAMPE: To the best of my knowledge,
21 that is the case, right.

22 JUDGE LAM: And may I ask you why you
23 had no opinion on that?

24 DR. CAMPE: Typically it's in the spirit
25 of what that NUREG section is all about. It's a --

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1 it is designed to provide a screening method. It's
2 a screening methodology in that chapter. And
3 typically in reviewing nuclear power plant
4 facilities, the frequencies and probabilities are
5 such that one can relatively easily, in most cases,
6 show that the hazard is not significant. My -- I
7 dare say that if one were to find, early on, a
8 clear indication that the likelihood was going to
9 be substantially over any acceptance criteria, and
10 deemed to be significant, I would have almost a
11 hundred percent assurance that the analysis would
12 include many other things, including design
13 features and other types of calculations, perhaps.
14 Again, I can't give you examples because I have not
15 seen any. But typically I can only relate to other
16 areas like in the case of Tornado missiles, in one
17 particular site, and I don't recall the name of the
18 site at the moment, but they were not able to
19 easily show a low enough probability against
20 Tornado missile protection. They resorted to Monte
21 Carlo analysis, which was not something that was
22 entertained in the NUREG 0800.

23 So my guess is that in those cases where
24 the early screening process gives you an early
25 indication that the numbers are going to be

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1 significant, that you would then expect any
2 methodology that's applicable to be used in order
3 to get your hands on what the actual probability
4 is.

5 JUDGE LAM: Thank you, Dr. Campe. May I
6 ask you a question, Dr. Ghosh?

7 DR. GHOSH: Yes, sir, your Honor.

8 JUDGE LAM: On Page 21 of your direct
9 testimony, answer to Question 39.

10 DR. GHOSH: Yes, sir.

11 JUDGE LAM: You mentioned you conducted
12 sensitivity analysis in which you change by a
13 factor of 20 of the increase in the likelihood of
14 failure to avoid. You changed that input by a
15 factor of 20 and see the output parameter increase
16 by a factor of 2.5.

17 DR. GHOSH: Yes, your Honor.

18 JUDGE LAM: Now, isn't it true, what you
19 are doing is really you are only changing a
20 parameter which is the successful avoiding hitting
21 the target by twenty percent. Basically there is a
22 multiplier there; it's one minus this probability
23 that you are changing. When you change a
24 probability from 0.10 to 0.20 you are changing
25 another input parameter, which is the success

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1 probability, from 0.99 to 0.80. So you are
2 basically changing one input parameter by twenty
3 percent. So you might do sensitivity analysis the
4 other way, changing another input parameter by
5 twenty percent, I do see my output parameter
6 increase by a factor of two. Is that a correct
7 interpretation of what you have done, Dr. Ghosh?

8 DR. GHOSH: Not really, sir. If you
9 look at that R parameter, it has two components; R1
10 and R2. And R1 has also two components; Pable to
11 avoid times Phit, the probability that given all
12 the control and time, still the pilot is not able
13 to avoid the facility. I changed that part of it.
14 So Pable to avoid, if you take that one minus that
15 is actually the R2 factor. So I changed the Phit
16 by twenty times and saw how that affects the
17 ultimate crash probability.

18 JUDGE LAM: I see. Thank you,
19 Dr. Ghosh.

20 DR. GHOSH: Thank you, sir.

21 JUDGE FARRAR: Dr. Ghosh, let me ask you
22 a couple of questions about the place you work at.

23 DR. GHOSH: Yes, sir.

24 JUDGE FARRAR: FFRDC stands for
25 Federally Funded Research --

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1 DR. GHOSH: And Development Center.

2 JUDGE FARRAR: Does that mean that they
3 get all their money from the Federal Government?

4 DR. GHOSH: Yes, sir. Although I think
5 we are permitted to do a small amount of work for
6 others. But there are a lot of restrictions on
7 that.

8 JUDGE FARRAR: Now, when you go to work,
9 say, over the last two or three years, you
10 personally go to work at this place, do you work
11 for anybody, have you worked for anybody other than
12 the NRC?

13 DR. GHOSH: In a very small percentage
14 of time. We have a program within the institute
15 where institute pays money to develop, like seed
16 money to develop new areas. And we have worked in
17 one case where like acoustic emission, when you
18 load something in compilation how the thing breaks.

19 JUDGE FARRAR: But so with small
20 exceptions you are basically a contractor --

21 DR. GHOSH: Yes, your Honor.

22 JUDGE FARRAR: If we cut through the
23 legal nicety, you are a contractor for the NRC?

24 DR. GHOSH: Yes, your Honor.

25 JUDGE FARRAR: Now, when you go to work

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1 you don't dream up things to do on your own.
2 Somebody in Rockville calls you and says, "We'd
3 like you to do this." They may have a formal
4 contract, but basically --

5 DR. GHOSH: Yes. Through our project
6 manager of the management.

7 JUDGE FARRAR: So while there may be a
8 formal contract, basically you have a contact there
9 who says, "Here is what I want you to do."

10 DR. GHOSH: Yes, sir. Generally we have
11 projects and things like that.

12 JUDGE FARRAR: Now, when you do your
13 work, suppose you had a project that was going to
14 take six months. Project manager calls you, you do
15 deliver him something six months later, never
16 having talked to him in the meantime? Or do you,
17 over the course of that six months, call and say
18 hey, "Here is where I am. What do you think of
19 this? What are you doing on other projects?" I
20 mean, is it an interactive process or do you go off
21 and do something and turn it in six months later?

22 DR. GHOSH: If I can characterize it, it
23 is extremely interactive. We talk maybe several
24 times in a day.

25 JUDGE FARRAR: That's what I would have

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1 expected, but it wasn't clear from what you had
2 said before. Judge Kline has some questions.

3 MR. KLINE: I have two or three subjects
4 I want to explore. The first has to do with --
5 they are nearly all regulatory type questions that
6 I would direct to Dr. Campe as being a long-time
7 regulator. And it will generally deal with
8 subjects starting on Page 6 of your testimony and
9 going on from that. But I first want to explore
10 with you the regulatory significance of the
11 criterion that has come to be called the 10-6
12 criteria which the Commission approved recently and
13 which we are apparently using as a test criterion
14 for compliance with NRC regulations. Do you rely
15 on the criterion 10-6 crash use per year in your
16 SER? That is, as a licensing document? As opposed
17 to the Part 100 criterion, that's the full
18 consequence type analysis. Just the crash
19 frequency data, do you rely on that to make a
20 licensing decision?

21 DR. CAMPE: As I understand it, and as I
22 have used the criterion in essentially all the work
23 I have done, in conjunction with the guidelines and
24 Standard Review Plan, the 10-6 as a criterion in
25 the power plant side of things is in connection

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1 with the tacit assumption of Part 100, those
2 guideline --

3 JUDGE KLINE: I understand. With
4 respect to the waste storage facility, we are using
5 or have been proffered that criterion. And I'm
6 trying to elicit from you what the regulatory
7 significance is. Is it just a guideline or does it
8 have -- is it something that is an enforceable
9 standard?

10 DR. CAMPE: As best I can answer it, I
11 don't believe I have seen anything numerically
12 expressed in, like, say Code of Federal Regulations
13 to that effect. If there is, I may have missed it.
14 It's a review guidance policy type --

15 MR. KLINE: It's a review guidance.

16 DR. CAMPE: Type criterion that we have
17 been using.

18 MR. KLINE: But you use it in an SER, or
19 do you not?

20 DR. CAMPE: Yes, sir.

21 MR. KLINE: So whether or not it is an
22 absolute regulation or not, can we say fairly that
23 it is part of the licensing basis? That is to say,
24 if the license were to be granted and that number
25 is used in the SER, then it certainly is a

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1 licensing basis, is it not? That is something you
2 relied on in order to grant the license.

3 DR. CAMPE: Right. I agree with that,
4 yes, sir.

5 MR. KLINE: And if the license is
6 granted, would it be fair to say that the NRC
7 would, at some point in the future, pay a visit to
8 the PFS site for the purpose of inspections?

9 DR. CAMPE: I believe there's -- to be
10 fully responsive to that, I believe there's at
11 least two parts that relate to that. First of all
12 it is my understanding that just in general, a
13 licensed facility is subject to a number of what I
14 would call feedback processes with many parties
15 involved. It can be feedback from public or local
16 residents, the state government --

17 MR. KLINE: I understand all that. I
18 don't mean to cut you off. What I'm really trying
19 to get at is in due course somebody from NRC, a
20 regional office will go to the site and inspect
21 what they are doing out there; right?

22 DR. CAMPE: That's what I was getting
23 to. There are many parts, including the inspection
24 processes of the NRC.

25 MR. KLINE: And I want to focus on that,

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1 the NRC spectrum.

2 DR. CAMPE: Okay.

3 MR. KLINE: We understand that there is
4 going to be inspections of that type going on.
5 Whatever else goes on, that goes on.

6 DR. CAMPE: At least. At least.

7 MR. KLINE: Okay. That's all I want to
8 know. Because the next question, then, is when the
9 NRC goes to the site to inspect it, isn't it true
10 that it inspects, at least partially, against the
11 SER? That is to say that if there's a licensing
12 basis out there, the inspectors at least have to be
13 familiar with it before they inspect? Is that
14 true?

15 DR. CAMPE: That is my understanding.
16 Again, at the very least. Then there are technical
17 specifications and the whole retinue of things.

18 MR. KLINE: Yes.

19 DR. CAMPE: But, yes.

20 MR. KLINE: Well, I'm still focused on
21 the regulatory significance of 10-6. That
22 criterion, then, has regulatory significance in
23 terms of licensing criterion and enforcement
24 criterion; does it not?

25 DR. CAMPE: Yes, it does.

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1 MR. KLINE: All right.

2 DR. CAMPE: The question of how you do
3 this is another matter.

4 MR. KLINE: No. I only want to know if
5 it is important in the licensing process.

6 DR. CAMPE: Yes, sir, I agree.

7 MR. KLINE: All right. So when we come
8 to holding, to judging the sufficiency of the case
9 against the licensing criterion, the question comes
10 up as whether the 10-6 criterion is a rigorous
11 bright line criterion that says if you exceed it,
12 you fall into a black hole, and if you get below
13 it, the sun shines on you. And there's nothing in
14 between. In other words, it's a hard and fast
15 regulatory criterion. Is that the way you use it?

16 DR. CAMPE: That's a toughy. Because so
17 many -- in my mind there's so many factors
18 involved.

19 MR. KLINE: I understand that. You
20 should have been listening to our discussions on
21 this.

22 DR. CAMPE: In the sense that we
23 normally, when we aim at that criterion with a
24 particular license, we have attached to it the
25 whole baggage of conservatisms. And there's the

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1 concept of looking at a probabilistic risk
2 assessment all the way to the sequences. And the
3 accident and so on that gives us some margin. So
4 from that sense, the strictness of that 10-6 is
5 moderated by how much margin there is behind it.
6 That's one thing.

7 MR. KLINE: Yeah.

8 DR. CAMPE: The enforcement part, I
9 personally don't know what the enforcement
10 procedures are as it relates to 10-6, how they
11 execute it, how strictly. I can't address that
12 personally.

13 MR. KLINE: I don't mean to explore any
14 further the enforcement. I only want to establish
15 that it is used in the regulatory process and
16 therefore, we have to explore what is its
17 regulatory significance; how hard a standard is it?

18 DR. CAMPE: Well, one thing that might
19 add to a better appreciation of how hard of a
20 standard it is, is that there have been times where
21 the acceptance process was considered to be just
22 barely so. In a situation like that, you are
23 saying to yourself, "I have made the best job I can
24 of projecting my analyses throughout the course of
25 the license of the facility. And I have come up

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1 with something that is acceptable, but it's kind of
2 close."

3 MR. KLINE: Close.

4 DR. CAMPE: To be erring on the prudent
5 side, on the conservative side, what can be done -
6 and this addresses, in a sense, the strictness of
7 this criterion - but one can and has in the past
8 entertained license conditions. For example, where
9 you say okay, we know the site as it is today is
10 kind of close. We would like to be vigilant. We
11 know there are processes in place that will raise
12 little flags down the pike at any time which we can
13 address. But in addition to that, we would like
14 the licensee to give us a timely and periodic
15 report on how the situation changed significantly,
16 every, whatever the number of years that one may
17 deem to be appropriate in a particular case. So
18 that gives us an opportunity, then, to, in a timely
19 fashion, re-review the situation. And again, it's
20 all with this criterion in mind. You are close to
21 it so you'd like to keep a closer eye on it.

22 MR. KLINE: One of the problems for
23 decisionmakers arises out of the practice of
24 submitting what you might call conservative
25 analyses as opposed to realistic analyses with

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1 confidence intervals around them. Because if you
2 did get close, then we don't know how much
3 conservatism you can apply to the question. I
4 mean, it's not very quantitative and it leaves the
5 kind of decision one can make in very difficult
6 territory.

7 In other words, I appreciate from the
8 Staff point of view it would like to make
9 conservative analyses and establish an upper bound
10 and let it go at that. If I were getting it, I
11 would rather have you present me a realistic
12 analysis, your best point estimate, with whatever
13 confidence interval it has around it. And I don't
14 know how we can do that. But it presents a
15 decisional problem. And maybe we have exhausted
16 everything to know about it. I don't know if I can
17 pursue it any further.

18 But then I want to go onto another issue
19 that I raised with the Air Force witnesses
20 yesterday. Or I can't remember if it was yesterday
21 or the day before. But in any case, the issue of
22 adapting the four factor analysis to site
23 specificity. And it raises in my mind -- I'm going
24 to talk about the R factor but I'm not going to
25 criticize its merits because that's been done

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1 enough already, so we don't need to go over that
2 territory again. I have a different problem with
3 the R factor. In fact I have two.

4 The first one is we elicited from the
5 Air Force witnesses the site-specific practice that
6 the aircraft just naturally fly formations down the
7 east side of Skull Valley, and are not spread
8 evenly across the available air space. And you may
9 have asked them to do that for conservatism. But
10 let's focus on the site-specific aspect because we
11 also elicited, and it seems likely that it's true,
12 that when aircraft fly in formations down Skull
13 Valley, they fly in parallel lines and they are
14 flying offset from the site. So as a natural
15 practice, they don't fly over the site very often.
16 Or even if they do, not all of them do. And your
17 own testimony sort of took advantage of that fact
18 and opened the door by taking some safety credit
19 for the fact that the outlying aircraft that were
20 fairly far offset didn't contribute much to risk.
21 Isn't that correct?

22 DR. CAMPE: That is correct.

23 MR. KLINE: So my question has to do
24 with the R adjustment factor. But it raises -- and
25 I need to explain it carefully. There is a

1 population -- that is, in a probabilistic analysis
2 there is a population of aircraft that transits
3 Skull Valley north to south annually. And the vast
4 majority of them, since they are flying offset,
5 never really fly over the site. Nevertheless, we
6 are taking, the Applicant is taking what amounts to
7 an R, I'm going to call it a discount factor, on
8 all the flights. My problem is that it's an
9 unweighted, an unweighted factor. That is to say,
10 most of the flights, that issue never comes up so
11 why do they get a discount factor?

12 Let us, as a hypothetical, say one out
13 of every four aircraft comes close enough to the
14 site, you know, in this offset flight pattern, to
15 warrant or raise an issue of pilot avoidance. But
16 you're giving the discount factor to the entire
17 population. So I need an answer to why we can use
18 a nonweighted discount factor that applies to all
19 the aircraft instead of the ones that, as a
20 statistical matter, make a close approach to the
21 site. Okay? So that's -- let's deal with that and
22 then go on.

23 DR. CAMPE: In responding, I would like
24 to respond to my understanding of it. But at the
25 same time I think I would like to also ask

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1 Dr. Ghosh to join in because he actually did some
2 of those calculations.

3 MR. KLINE: By all means. Whoever
4 really knows is free to answer.

5 DR. CAMPE: The only thing I would like
6 to note of what you pointed out, which is a good
7 observation, is that when you consider the effect
8 of formation flight and, as you pointed out, given
9 a formation then by default one of the outlying
10 wing flights will not be eligible to fly over. So
11 why apply a discount factor. Well, at least in our
12 calculation, because we were disallowing that
13 flight because of formation default. Application
14 of discount to zero essentially doesn't do
15 anything. That's my first reaction to that.

16 MR. KLINE: Okay.

17 DR. CAMPE: I don't know if Dr. Ghosh --

18 DR. GHOSH: I didn't look at it that
19 way, but we used two discount factors; one is zero
20 and the other is R. The one where we have taken
21 the discount, we equated R to zero.

22 MR. KLINE: I understand what you did in
23 creating your own confirmatory analysis. But you
24 also approved or appeared to approve what the
25 Applicant had submitted. And I think we have

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1 testimony that indicates that the Applicant
2 couldn't meet the regulatory criterion absent the
3 use of the discount factor. And much of the
4 criticism of the discount factor is that it appears
5 large; 85 percent of the whole risk is accounted
6 for or discounted by the use of that factor.

7 It would seem to me that it would be
8 interesting to see the calculation, if we could
9 work out a way, you know, by taking account of the
10 site-specific conditions, work out a way to create
11 a weighted discount factor that only applied to the
12 aircraft that were in harm's way anyway, or in the
13 first place. And if you wanted, you know, if you
14 wanted to rule out half of the aircraft as you did
15 or find some other way to do it, I would just ask
16 if it is valid, in your mind, to somehow approach a
17 weighted discount factor that sort of takes account
18 of the site-specific practices that go on in Skull
19 Valley.

20 DR. CAMPE: I believe it's valid. I
21 would like to check to see whether or not we,
22 indeed, have done it. Perhaps as a side
23 calculation. I would have to check with Dr. Ghosh
24 on that.

25 MR. SILBERG: Could I just ask a

1 clarifying question so I understand?

2 MR. KLINE: Yes.

3 MR. SILBERG: Your discussion or your
4 question is could you do a calculation which only
5 counts those planes that could reach the site --

6 MR. KLINE: No. I'm talking -- now, in
7 terms of probabilistic analysis we look at
8 likelihoods. That is to say, there's a population
9 of some 6000 aircraft that transit Skull Valley.
10 The vast majority of them, it would appear to me,
11 since they are flying parallel and offset, it would
12 appear subjectively that most of them are never
13 pointed at the PFS site in the first place. Given
14 that, why do they get a discount? As a
15 hypothetical, let us say only the western-most
16 aircraft ever approaches PFS. So three out of four
17 aircraft pass by it. Not that they could never
18 reach it; it's just that they are never pointed
19 that way in the first place. So if they got in
20 trouble, pilot avoidance just doesn't come into it
21 or would not likely come into it. I understand
22 there are complexities related to last minute turns
23 and that sort of thing. But in terms of
24 predominant flight paths, why wouldn't we apply
25 some form of weighting factor to the discount

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1 factor that takes account of that fact?

2 DR. GHOSH: Yes, probably we can do it.

3 And if I may, if you allow me to go back to your,
4 yesterday, one question I tried to bring that in
5 and tried to give my thoughts to that. Yesterday,
6 one of the weaknesses like, if we make graph paper,
7 how the distribution looked like. Like a normal
8 distribution or something like that. The NUREG
9 material is a screening criteria so it has to be
10 very conservative. So it takes a uniform
11 distribution like on the left of the center line or
12 right of the center line, you still have a finite
13 probability. It should be normal probability with
14 both ends chopped off. Because --

15 MR. KLINE: Ideally we should have a
16 Gaussian distribution of --

17 DR. GHOSH: With a limited range.

18 MR. KLINE: Yes. Of weighting factors.
19 I understand that. That would convert it to
20 something like a Monte Carlo analysis.

21 DR. GHOSH: Right.

22 MR. KLINE: But even granted that we are
23 not likely to get that, we sort of know where the
24 peak risk is and we know where the essentially zero
25 risk is from the Air Force witnesses. And it would

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1 seem to me that we could somehow work out at least
2 the first approximation, because this is important.
3 And I'm going to explore further regulatory
4 implications of the R factor when we are done with
5 this. But given that the application relies on it
6 to meet the 10-6 criteria, it would seem to me that
7 it is key to get it right. And so I just leave
8 that with you. I don't know if you have an answer
9 now or not.

10 DR. CAMPE: I think what you are saying
11 is reasonable and makes sense, and I agree with
12 that. And I further believe that we have all the
13 elements captured and perhaps just not organized in
14 the way that you are describing. It should be
15 doable, in my opinion.

16 MR. KLINE: Okay.

17 JUDGE LAM: If Judge Kline would permit
18 me, I would like to chime in for one question.

19 MR. KLINE: Please do.

20 JUDGE LAM: It seems to me in the
21 Staff's confirmatory analysis, the Staff also took
22 credit for the pilot being able to avoid a land
23 target. And that credit amounts to roughly 90
24 percent in Skull Valley. Is that the correct
25 observation? This relates to Judge Kline's mention

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1 of discount factor.

2 DR. GHOSH: Yes. We use that R1 to be
3 able to apply to 90 percent.

4 JUDGE LAM: This is the discount factor
5 you are talking about with Judge Kline.

6 MR. KLINE: In any case, I do believe it
7 would be important to calculate a weighted discount
8 and determine if it meets the regulatory criterion
9 that we are using in this case, as part of the
10 review. So I'm going to leave it there. And
11 regulatory staff can just decide what they --

12 DR. GHOSH: If I may add a little. We
13 tried to take a first stab at it, taking 50 percent
14 out of the picture because they are knowingly away
15 from the site. And what we try to do is, like, we
16 do not have a better control like how the pilot
17 will behave. We assume given a chance they may go
18 from the regular path. So we randomly placed that
19 we have a uniform probability to be anywhere where
20 they are allowed to go, where they don't
21 practically go. We made a difference in that.

22 MR. KLINE: When I read your testimony,
23 I did read into it that you were trying to grapple
24 somehow with this question. And that you did it by
25 discounting the outboard flights. And I leave the

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1 approach to you. I just raised the question as to
2 what would happen. I mean, it would appear -- I
3 don't know whether the application would meet the
4 criterion we have been given if there were some
5 sort of realistic discount or weighting to the R
6 factor. And I don't know where to go with it from
7 here because we don't really have a solid answer.
8 And I will leave, you know, leave it there.

9 But I have another question relating to
10 R factors. And again, it's a regulatory question.
11 And that is when you -- we have -- that is, when we
12 normally license a plant of any kind, a nuclear
13 facility, the licensing documents represent the
14 agreements and commitments between a licensee and
15 the regulator. Isn't that a fair way of looking at
16 it?

17 DR. CAMPE: I believe so.

18 MR. KLINE: Okay. That the licensee
19 becomes fully liable for enforcement or for seeing
20 that everything in the licensing documents is
21 carried out just like it says there.

22 DR. CAMPE: Yes.

23 MR. KLINE: Okay. Now, in this case we
24 have a regulatory issue that hasn't really been
25 brought up so I'm going to bring it up now. That

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1 is, regardless of the merit of the R factor, let us
2 assume the absolute truth of it, so if a license is
3 granted on the basis that Air Force pilots will
4 perform in some certain way, we have a licensing
5 basis that depends on the performance of an
6 unlicensed third party. And the question is, do we
7 have regulatory practice that permits us to, in
8 effect, rely for regulatory compliance on somebody
9 we can't inspect, we can't issue a regulatory order
10 to, we can't issue civil penalties to? In other
11 words, no matter how good their intentions are, we
12 have no regulatory authority over them. So that an
13 essential matter of safety is now delegated outside
14 of the loop that is comprised by the regulator and
15 the regulated entity. And so I guess the question
16 I have is how do we cope with that?

17 I understand that there are times when
18 third parties, let us say equipment suppliers and
19 so on, are unlicensed and we depend on them for
20 safety. But we do have access to them as
21 enforcement matters. And so I need to understand
22 when we have -- are we able, in your mind, as
23 regulators, to put that level of reliance where the
24 license is essential to their performance and they
25 are outside of the regulatory loop?

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1 JUDGE LAM: Before he answers, let me
2 make sure the record reflects the third party Judge
3 Kline referred to is the United States Air Force.

4 MR. KLINE: Yes. That's true. But if,
5 for example, the Air Force had applied for a
6 nuclear license of its own, they would be subject
7 to our regulation. And I know we have a naval
8 reactor in Bethesda that is subject to our
9 regulation. So the fact that they are a government
10 agency doesn't automatically leave them out of our
11 regulatory purview. But I haven't seen how it is
12 to be employed here.

13 DR. CAMPE: Yes, sir. I can only offer
14 what my understanding of that issue is. I don't
15 find it to be something new. It is something I
16 have thought about and dealt with, I think, from
17 time to time.

18 MR. KLINE: Okay.

19 DR. CAMPE: And it involves, perhaps, a
20 different perspective on some of the elements that
21 you outlined that categorizes the issue into a
22 different box or a different shape. I look at it
23 this way: That we start out with one of the
24 essential quantities that determine the overall
25 probability, namely that is the crash rate. The

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1 likelihood that something will go wrong with
2 respect to the aircraft. And we then go to see
3 what is available in terms of actual historical
4 data, actuarial type data. This is no different
5 than dealing with any other historical data that we
6 use to build probability from. That includes the
7 captures, any and all things such as human factors
8 and error rates and what have you, training and
9 maintenance and everything else.

10 So from the perspective of the R factor
11 in this case being derived from looking at actual
12 historical data, from that point of view there is
13 no third party, per se. It happened. It happened,
14 there is historical data, you dip into it.

15 However, where we have concern, where
16 the concern now shifts over to, and this is the
17 job, the tough job in front of us, is to evaluate
18 have we done a good enough job in evaluating that
19 database to satisfy ourselves that we have a good
20 reading on a trend, whatever that trend is?

21 So from that kind of perspective, I
22 don't see a third party liability. The Air Force
23 pilots' performance, that performance they used
24 historical data as a measure of what that
25 performance level is. And you do your best as far

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1 as projections and so on. I see your point, where
2 you could be in a situation where you separate out
3 those factors. If you are doing it from first
4 principles, building up a probability from first
5 principles and you addressed the human factors,
6 then you are absolutely correct in saying, "Well,
7 we are depending on a human factor that is under
8 the jurisdiction of U.S. Air Force. We have no
9 control over it." But here we are, in my opinion,
10 looking at the actuarial data. And then the only
11 job is have we done the right interpretation of
12 that data? And that's where the expert opinion of
13 the Air Force people came into and extracting that
14 data; is it right, is it wrong. That is my view.

15 MR. KLINE: I'm not going to argue with
16 you but to illustrate my point, your analysis
17 treats all the factors that go into the analysis as
18 if they were laws of nature. That is to say,
19 intrinsic crash rates are whatever. But here we
20 are really strongly dependent on assertions of
21 future performance, human performance.

22 DR. CAMPE: That's correct.

23 MR. KLINE: Somewhere there's a 24-year-
24 old kid who suddenly gets assigned to Hill Air
25 Force Base and the whole licensing structure

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1 depends on him doing it right. And I wonder, you
2 know, if this gives old regulators a little heart-
3 burn.

4 DR. CAMPE: I totally agree with you.
5 But to me it is a matter of projection. And you
6 are right; it's, "Have you done the projection
7 right?" It is a difficult one.

8 MR. SILBERG: Judge Kline --

9 DR. CAMPE: You can't touch that.
10 That's already happened.

11 MR. KLINE: I'm going to stop now. I
12 see there are others who want to jump in.

13 MR. SILBERG: If I could, as an old
14 regulatee, I wondered if I could offer a few
15 perspectives not as an evidentiary matter but I
16 think this is really not an evidentiary question.

17 MR. KLINE: But as a regulator, I'm not
18 asking a lawyer, I'm asking an experienced
19 regulator.

20 MR. SILBERG: As an experienced
21 regulatee the idea of third parties doing things
22 outside the control of the regulatee in the future
23 and how one handles that is something that is
24 routinely done in these cases. Whether it is
25 predicting who is going to move next door to your

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1 facility, what population changes will be, whether
2 someone is going to move an air route over your
3 facility or away from your facility, whether
4 someone will reopen an LNG terminal 3 miles from
5 the Calvert Cliffs plant, whether they will start
6 shipping LNG down a waterway. All of those are
7 future changes that could occur that are totally
8 outside the control of the licensee. These are
9 things that the NRC routinely looks at. Licensees
10 are obligated to tell the NRC about them.

11 MR. KLINE: Let me give an illustration
12 of my concern and I'll take it from a different
13 case so we don't get involved in the facts of this
14 case. In the Shorum case we did emergency
15 planning. And the granting of a license on a
16 finding of satisfactory emergency plan depended on
17 the performance of radio stations to broadcast the
18 emergency message.

19 Now, in that case, the regulators saw
20 fit to obtain from the radio stations, that is for
21 the licensee to obtain, letters of agreement where
22 the radio station agreed in advance that it would
23 grant or would broadcast emergency messages when
24 called upon. And the Commission had accepted
25 letters of agreement as evidence of future

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1 performance of the radio stations. Now, that is
2 sort of -- I don't, you know. That is the kind of
3 regulatory assurance that at least gives us some
4 assurance that somebody who is intimately involved
5 in the licensing decision, not just peripheral to
6 it, but somebody that is being relied on requires
7 some sort of regulatory assurance of performance.
8 And I don't know just --

9 DR. CAMPE: If I may just add to that
10 that we did, a little while ago, address that
11 aspect to some extent through the process of
12 inspection and watchfulness. So I don't know about
13 isolated incidents. Obviously you could always
14 have a bizarre incident. Somebody, I don't know,
15 is suicidal and whatever. But as a trend, if there
16 was a noticeable trend, whether it is on the lack
17 of attention on the part of the Air Force or
18 whatever, if it came to our attention, I think we
19 are in the -- there is a process for addressing
20 that.

21 MR. KLINE: All right.

22 JUDGE FARRAR: Let me get right in on
23 that point, then, and let's start with Mr.
24 Silberg's example of Calvert Cliffs. If the LNG,
25 and I forget the exact details, but if the LNG

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1 facility is opened or reopened or whatever the
2 facts are, is that something that the Staff would
3 look at and say, "Now we have a new threat, a new
4 possible risk to the safe operation of the Calvert
5 Cliffs facilities."

6 DR. CAMPE: As a matter of fact, I'm
7 involved in that at the moment.

8 JUDGE FARRAR: Let's get back to this
9 case. Again, this is along the same lines as Dr.
10 Kline. Suppose the base-closing commission closed
11 a whole bunch of Air Force bases and everything was
12 switched to Hill, and three years from now there
13 were three times as many flights as are listed
14 here. You would sooner or later become aware of
15 that from some source.

16 DR. CAMPE: That is my expectation, sir.

17 JUDGE FARRAR: What would you do then?

18 DR. CAMPE: We would then interface with
19 the licensee, examine the issue, determine the
20 nature of it, the extent of it, and I can't at this
21 moment give you a specific direction. But
22 something would be pursued.

23 JUDGE FARRAR: So in other words, as
24 part of your enforcement or regular supervision --

25 DR. CAMPE: Absolutely.

1 JUDGE FARRAR: -- you would say to the
2 licensee, "What about this? Let's recalculate the
3 numbers and see how we are going to take care of
4 this in the regulatory scheme."

5 DR. CAMPE: That is correct, sir.

6 JUDGE FARRAR: And let's -- going down
7 the formula here, if you learned, I think you said
8 this already, if you learned that the crash rate
9 for F-16s dramatically changed, whether new
10 newspaper stories or whatever, you would say to the
11 licensee, "Hey, what about this? "

12 DR. CAMPE: Absolutely.

13 JUDGE FARRAR: "We have all these things
14 flying somewhere nearby and they seem to have a lot
15 more trouble than we expected. What are we going
16 to do about this? "

17 DR. CAMPE: Very good example of this,
18 recently for the same Calvert Cliffs we had feed-
19 back from area people saying, "We see planes
20 flying. What is going on?" We looked into it and
21 made a re-evaluation.

22 Q. The effective area of the plant; if all
23 the sudden the transfer facility got to be twice as
24 big or they wanted to have more casks or spread
25 them out farther, you would, on your inspection,

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1 you would notice this and you would do the same
2 thing?

3 DR. CAMPE: Yes, sir.

4 JUDGE FARRAR: Now we come to the R
5 factor. How do you follow up on that? How do you
6 make sure the pilots have the same mental attitude
7 that the witnesses said they trained them to have?
8 And that's the thrust of Judge Kline's question is
9 here's something that not only is not being done by
10 the Applicant, but it's not being done by anyone
11 the Applicant has any kind of control over, and
12 it's not being done in a way that anybody is ever
13 going to learn about it. That's the problem here.
14 When you put in the R factor you have suddenly put
15 in a factor different from anything Judge Kline has
16 ever heard of. You can't expect for it, you can't
17 regulate it. You can't ask the Applicant to do
18 anything about it. And all of the sudden you have
19 licensed the facility on a determinative factor
20 that is totally outside the system. I think that's
21 a question.

22 DR. CAMPE: It is. I fully understand
23 it, your Honor. I fully understand it. And it is,
24 I think, a fair observation. At the moment, we
25 can't make any direct connection to any inspectable

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1 item or anything along those lines. Certainly if
2 one wanted to make efforts into direction, one
3 could conceivably hone in on monitoring the
4 performance level either for the entire Air Force
5 or for Hill base. I do this informally, for
6 example. I maintain a watch over crash rates and
7 so on. Just as a general activity. But one could
8 specifically approach it for a particular facility.

9 JUDGE FARRAR: But you don't --

10 DR. CAMPE: It's not the same as
11 counting airplanes, which is rather easily done.
12 And you don't want to rely on measured crash data
13 because it is too late. You want to get to the
14 root of it. And if there was some means of
15 monitoring the level of performance at the base,
16 which may very well mean you have to get a tie-in
17 with their Safety Board activities and their
18 fundings because they do this regularly, on a
19 monthly basis, as I understand it. So there's a
20 way to feel the pulse, as it were, and use that.
21 But that's something I have not seen anybody
22 formulate. But these are the thoughts I have in
23 response to that.

24 JUDGE FARRAR: In that regard, do you
25 have a lot of extra people on your staff who are

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1 not doing much who could take on these extra
2 duties?

3 DR. CAMPE: I don't know, your Honor.

4 JUDGE FARRAR: That's a partly facetious
5 question. But I don't understand that there's a
6 lot of spare time available for the staff to take
7 on, in this case, what would be or seems like is an
8 extraordinarily difficult duty compared to
9 counting, as you said, counting airplanes and so
10 forth.

11 DR. CAMPE: Well, not to sound flippant
12 but the easy way out to me would be to explore
13 having something that the licensee would be
14 obligated to monitor or keep an eye on and be
15 obligated to report to us. It is not that
16 difficult to do that once the process is set in
17 place. It may take a while to reach a viable
18 process for monitoring it, but once there was an
19 approved process for it -- I'm not inventing this.
20 I'm saying this because I know there have been
21 licensing conditions of one sort or another placed
22 on licensees.

23 JUDGE FARRAR: This would be somewhat
24 unlike any other license condition you have ever
25 been involved in in the aircraft area, would it

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1 not?

2 DR. CAMPE: More than likely, yes, sir.

3 JUDGE LAM: Are you saying you think the
4 agency would be able to impose a license condition
5 on the U.S. Air Force?

6 DR. CAMPE: No, not on the Air Force.
7 The licensee would be obligated to provide a
8 monitoring program of some sort by some measure
9 that would give us an indication of whether things
10 are going wrong or not. I'm not suggesting that we
11 do something in terms of controlling the Air Force
12 activities.

13 JUDGE LAM: But what could the licensee
14 have done if Judge Farrar's hypothetical scenario
15 comes into play, which means significant flight
16 activity would be over the site? What could the
17 licensee have done? There are 4000 casks sitting
18 out there and flights overhead. What am I going to
19 do if I were the licensee?

20 DR. CAMPE: I'm sorry. I may have
21 misunderstood. I was addressing how you monitor
22 the R factor aspect. As far as overflights, in my
23 opinion that's a much more easily monitored item.
24 Now I think what you're addressing, Judge Lam, is
25 that given that there is a noticeable increase in

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1 air activity, what do you do about that?

2 JUDGE LAM: Right.

3 DR. CAMPE: The only thing I can draw
4 from my experience is that there are such things
5 as -- I don't know if I have the right terminology,
6 but interagency agreements or things of that
7 nature. We have had occasion to move air training
8 routes. The country is criss-crossed by training
9 routes all over the place. And if we notice that a
10 particular -- and, I'm sorry, I'm rushing. These
11 routes come and go. New ones get approved and old
12 ones get removed. So you keep an eye on that. If
13 you find one that, by some oversight, has moved too
14 close to a nuclear plant, in the past it has been
15 rather easily corrected.

16 Training routes are typically owned by
17 like the National Guard unit or some state. You
18 simply get in touch with them, explain your
19 situation, and they usually have no problem moving
20 their route. In the case of Skull Valley there may
21 be different factors to consider. But that's the
22 first thing that comes to my mind, because it is
23 mutual interest for both parties to do something
24 that safeguards the public.

25 JUDGE LAM: Thank you.

1 JUDGE FARRAR: But that sort of
2 monitoring condition put on the Applicant, and the
3 potential remediation still sounds a lot easier to
4 accomplish than some sort of monitoring condition
5 on the Applicant about the pilot avoidance factor
6 and a remediation condition, or step.

7 DR. CAMPE: It could be. I don't know
8 that for a fact. I do know that Air Force being
9 very focused on their own safety record and
10 maintaining it, have an almost continuously flowing
11 stream of data on the performance of their own
12 military aircraft. So it is just a question of
13 tapping into that process. In my mind it seems
14 that once you do that, create that process, then
15 the continual monitoring of it is not a big item.

16 JUDGE FARRAR: Except for the fact that
17 we were obviously struggling the last few days to
18 find out a pilot's state of mind. State of mind is
19 a harder thing to monitor than number of flights or
20 number of crashes.

21 DR. CAMPE: Yes. The factors that
22 contribute to avoidance or not avoidance and
23 performance of pilots in general, those are, you
24 know, may not be easily gotten to. But insofar as
25 keeping an eye on accidents and what the causes

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1 were, that seems to be a viable thing to do.

2 JUDGE FARRAR: But that's not the R
3 factor. Hold on a minute here and we will see what
4 else, where we want to go.

5 (The Board confers off the record.)

6 JUDGE FARRAR: Dr. Campe, I think we
7 are finished, at least as far as the Board is
8 concerned, with that subject. But I have one last
9 question. Mr. Soper showed you a 1984 licensing
10 board decision in which you testified and which the
11 licensing board said you had a different view or,
12 in effect, rejected your testimony. You said you
13 had never seen that decision.

14 DR. CAMPE: That is correct.

15 JUDGE FARRAR: Can you explain how that
16 could have come about?

17 DR. CAMPE: I honestly don't recall the
18 specific circumstances of that time period. I only
19 recollect some isolated things about the hearing.
20 It's been a long time ago.

21 JUDGE FARRAR: Let me interject there
22 before you go on. Mr. Silberg cited a case I
23 worked on in 1971 and I remember every precise
24 detail of that case.

25 DR. CAMPE: I envy you, sir.

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1 JUDGE FARRAR: And it strikes me that
2 the level of the work you are doing here -- that
3 was not the only case I was working on in 1971 for
4 the government. It strikes me that the level of
5 work you are doing here is every bit as important
6 as the level of work I was doing in that case. And
7 maybe the more important point than whether I
8 remember every detail is when we filed the Supreme
9 Court brief and the Supreme Court came out with its
10 decision, that was the first thing I wanted to read
11 that day. That's a question.

12 DR. CAMPE: I can't explain what it was,
13 whether it did or not. I simply don't recall
14 looking at it. I may have looked at it. It was an
15 early experience on my part. I hadn't been there
16 that long. For some reason, the only thing that
17 really sticks out in my mind is the net result of
18 that hearing, which to me was the important thing.
19 The net result of that.

20 JUDGE FARRAR: And the net result was --

21 DR. CAMPE: Not the numbers, but the
22 actions subsequent to that.

23 JUDGE FARRAR: And the action was or the
24 net result and action was?

25 DR. CAMPE: The action of that

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1 particular case, as I recollect, was -- and this
2 was with respect to the bombers; that the existing
3 bombing range which was simply a route over Lake
4 Michigan that was used with what is called
5 electronic bombings, not real bombs, that you
6 electronically score and training missions, through
7 interagency directive or something of that nature,
8 this was SAC, Strategic Air Command at the time,
9 they moved the route something like I believe on
10 the order of four miles, if I'm not mistaken, away
11 from the plant. That I remember.

12 JUDGE FARRAR: Mr. Soper, does the
13 Board's questions lead you to want to do more
14 cross? And if so, how much in terms of whether the
15 reporter needs a break or not?

16 MR. SOPER: I would just ask one
17 question, your Honor. If I might. Would that be
18 appropriate before we break?

19 JUDGE FARRAR: Yes.

20 MR. SOPER: Dr. Campe, I notice in your
21 response to the Board, that you suggested maybe the
22 Applicant could continue to monitor the ability of
23 pilots to avoid the site. Is that correct?

24 DR. CAMPE: I don't think I intended to
25 mean it directly just at that aspect, mainly

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1 monitor pilot's ability to avoid targets. I'm
2 saying to capture that, this is the main factor
3 that is in contention. If there was some way of
4 doing that, primarily through accident records that
5 are being compiled by the Air Force. Factor in --

6 MR. SOPER: Let me state my concern and
7 you can respond.

8 DR. CAMPE: Yes, sir.

9 MR. SOPER: It seems to me it's the R
10 factor where we are delegating our hopes that
11 pilots will avoid this site to the United States
12 Air Force. And it's on some degree, to some degree
13 that we have attempted to quantify. And in doing
14 that, in a review of ten years of accident reports
15 we have found twelve anecdotal references that,
16 arguably, through the interpretation of two
17 generals, refer to this. It doesn't seem to me
18 that the Applicant on, an ongoing basis -- in other
19 words, if things repeat in another ten years we
20 will have another twelve maybe anecdotal examples
21 to be opined on by generals. Do you see any
22 realistic way that the progress of whether or not R
23 is getting better or worse could possibly be
24 monitored?

25 DR. CAMPE: I can't formulate a plan for

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1 you at this moment right here as I sit. I would
2 have to spend some time in doing research on it.
3 All I can offer is an opinion that this is a
4 viable, a possibly viable thing to do. But I can't
5 give you a plan at the moment.

6 MR. SOPER: I think that demonstrates
7 the concern I had on my mind, your Honor, thank
8 you.

9 JUDGE LAM: May I add to the discussion,
10 Mr. Soper?

11 MR. SOPER: Please, Judge Lam.

12 JUDGE LAM: In the Applicant's analysis,
13 as you had heard in the past two days, there were
14 twelve reports of what the Applicant called clear
15 documentation; a pilot was successful in avoiding a
16 target. Mr. Soper disputed that claim in saying
17 "anecdotal evidence". Let me give the benefit of
18 the doubt to the Applicant. Assume there are 12
19 clearly documented cases of pilots successfully
20 avoiding the target. The Applicant's analysis
21 includes 61 events. And the Applicant claims there
22 are 59 events in which the pilot was able to avoid.
23 Therefore they came up with a probability of 97
24 percent.

25 In General Jefferson and General Cole's

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1 testimony they agree with my assessment of twelve
2 of the events clearly documented. The rest they
3 rely on expert opinion because they assert there
4 was time for the pilot to react, there was plenty
5 of Air Force training, there was motivation, and
6 then there was the Air Force officers' attitude.

7 My question to you is this: In your
8 confirmatory analysis, to what level of detail have
9 you examined that claim? Because by describing
10 what I had said, which General Jefferson and
11 General Cole agree, I only see historical data
12 supporting a 19 percent success probability for
13 pilot to avoid. In order to come up to 95 percent,
14 the remaining events need to be judged with expert
15 opinion. And there lies the essence of a question
16 that Judge Kline asked you, Dr. Campe. Are we
17 relying on a third party's performance for us to
18 make sure that this facility is safe, historically,
19 not in the future? Because this data is the ten
20 years data. So if I may refresh your memory about
21 my question, gentlemen: To what level of detail
22 have you examined this data? And also, what
23 opinion do you have? Obviously you have agreed
24 because in my earlier question to you, your answer
25 was the staff took credit of allowing 90 percent

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1 success probability for a pilot to avoid a land
2 target.

3 DR. CAMPE: I will try to answer and
4 then to whatever extent Dr. Ghosh would like to
5 join in on that.

6 JUDGE LAM: Please.

7 DR. CAMPE: I reviewed the discussion of
8 the reports, the description of the reports and the
9 actions that were looked at by the expert panel.
10 And reviewed it in the sense, does this make sense
11 to me? Do I believe this or not? Is there
12 something here that is hard to believe? What is
13 the credibility level? Things of this nature.
14 This is the level of review that I have done on
15 these accidents.

16 I did not go like, for example, to
17 personal interviews of the survivors or the Air
18 Force to any extent. And I basically used judgment
19 in my own behalf in reading this, whether this is a
20 reasonable description of an accident or not. I do
21 recall, for example, in some cases where the
22 categorizations were made regarding applicability
23 of events to Sevier B or Skull Valley. And some of
24 the factors that were used like weather, altitude,
25 and so on, there were questions in my mind on some

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1 of them. Like I looked at some of the variables
2 and said, "I don't see how this relegates the data
3 into this data bin or that data bin." When I saw
4 that, in these cases we had opportunity to discuss,
5 as part of confirmatory analysis, we had the
6 opportunity to discuss this with the Hill Air Force
7 Base personnel, asked them, "Does this make sense?
8 Yes or no?" That kind of thing. That's about the
9 level that I have done on that.

10 DR. GHOSH: Yes. I have nothing really
11 more to add to what Dr. Campe has said.

12 JUDGE LAM: Thank you, Dr. Ghosh and
13 Dr. Campe.

14 JUDGE FARRAR: Mr. Soper, does this
15 trigger any more questions for you?

16 MR. SOPER: I think that's been covered
17 pretty well, thank you.

18 JUDGE FARRAR: Any staff want any
19 redirect?

20 MR. TURK: Yes, your Honor.

21 JUDGE FARRAR: Of any appreciable
22 length?

23 MR. TURK: Could go twenty to thirty
24 minutes.

25 MR. SILBERG: I have a number of

1 questions that I would like to ask on a follow-up
2 basis from the discussions on cross.

3 JUDGE FARRAR: Then let's take a break
4 for the reporter's benefit. And it's quarter of.
5 Let's come back at five minutes to 6:00.

6 (A break was taken.)

7 JUDGE FARRAR: We are back on the record
8 and Mr. Turk, or Ms. Marco, redirect.

9 MR. TURK: I think I get the dagger, the
10 assignment.

11

12 REDIRECT EXAMINATION

13 BY MR. TURK:

14 Q. First I'd like to note that I have
15 learned many things from Mr. Soper in the last
16 several days, and one was his observation that they
17 could estimate how long the questions would take
18 but he can't estimate the answers. I have about
19 five minutes of questions but I think we will be
20 probably talking for 20 to 30 minutes.

21 JUDGE FARRAR: Our goal is, if nothing
22 else, to let these two be able to be excused,
23 excuse these witnesses this evening. Dr. Campe, it
24 is difficult enough to be getting sicker and sicker
25 while you are at an event you enjoy, much less

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1 something like this. So we will -- let's commit
2 that whatever else happens within the next hour and
3 40 minutes we finish with these witnesses.

4 MR. TURK: I appreciate that, your
5 Honor. It may be, however, that overnight the
6 witnesses may be able to come back to you with the
7 kind of calculation that you had asked for; a more
8 realistic evaluation of N with or without that R
9 factor, which is the subject of a question by your
10 Honors. And if that's possible, we will bring it
11 to you first thing in the morning and make that a
12 very short presentation.

13 JUDGE FARRAR: Okay.

14 MR. TURK: Your Honors, this was not the
15 subject of any questioning by the Board or Soper
16 but the Staff did introduce Staff Exhibit D and I
17 thought it might be useful on the record to explain
18 what this is.

19 JUDGE FARRAR: Okay.

20 Q. (By Mr. Turk) Recognizing it is outside
21 the scope of previous questioning, I would ask
22 Dr. Campe, could you explain what this depicts?

23 DR. CAMPE: Basically it shows the
24 contour of a portion of Skull Valley in the
25 vicinity of PFS, or the latitude of PFS; an

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1 east/west slice through the valley where the
2 elevation is measured in feet above mean sea level.
3 And then laterally it is the distance in reference
4 to the proposed storage facility.

5 Q. In your opinion is the vertical scale
6 approximately equal for the horizontal scale on
7 this graph?

8 DR. CAMPE: Yes. That was the main
9 reason for my wanting to construct this graph,
10 because I wanted to see an undistorted view of the
11 profile. The figure that was offered in the
12 aircraft crash accident report by the Applicant
13 showed a figure that had the vertical scale
14 exaggerated. And if you are looking at a
15 two-dimensional space, which is a slice of air-
16 space, to get a better appreciation of what it
17 actually is I felt it should show an undistorted
18 scale. And this is an attempt to do so. In
19 addition to that, I tried to indicate here the
20 approximate boundaries of the Sevier B MOA and the
21 1000 feet AGL lower limitation line, and the
22 indication of where the general area of Stansbury
23 mountains are.

24 Q. Just going through it quickly, the area
25 shown in orange at the bottom, that is ground?

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1 DR. CAMPE: Yes, sir.

2 Q. And then there's a thin blue band above
3 that, that's the 1000 AGL boundary, a space up to
4 1000 feet above ground level, is it?

5 DR. CAMPE: That's correct.

6 Q. The grey area above that, that's the
7 portion of Sevier B MOA above the 1000 foot AGL
8 mark?

9 A. That's correct.

10 Q. And then above that in blue, it comes in
11 approximately at 10,000 feet in this depiction.
12 But is that approximately the 9500 feet mark where
13 space above Sevier B begins?

14 DR. CAMPE: That's correct. I think I
15 labeled the graph itself at 9500 MSL even though it
16 looks like -- the printer here may have done its
17 job on displacing line. I don't know. But it is
18 9500 feet.

19 Q. Thank you, I just wanted that to be
20 clear on the record. In a question by Mr. Soper
21 earlier today, you made reference to the reason why
22 you considered a 4000 cask load. And in your
23 testimony you described this as being something
24 related to the end-of-life-of-the-facility load.
25 Do you recall that testimony?

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1 DR. CAMPE: Yes, sir.

2 Q. Did you mean to say that you believe at
3 the end of the twenty year license term there will
4 be 4000 casks at the site?

5 DR. CAMPE: You make that assumption
6 because that's the maximum capacity of the
7 facility. And so to be on a conservative side
8 that's the assumption I'm making.

9 Q. Do you have any knowledge as to what the
10 plans are for removing casks from the site or
11 whether there will be that many casks at the site
12 at the end of the twenty years?

13 DR. CAMPE: No, I do not.

14 Q. Also, in connection with that same part
15 of your testimony, you indicated that you had done
16 a rough approximation, I believe is the terminology
17 you used. Do you recall that?

18 DR. CAMPE: I'm sorry. I missed -- I
19 think I may have missed the first part of the
20 question. Rough approximation of what?

21 Q. When you were discussing your use of a
22 4000 cask assumption, I believe you called that a
23 rough approximation? Do you recall using those
24 words?

25 DR. CAMPE: I believe I made that

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1 statement in reference to the effective area, when
2 talking about A and the four-factor formula.

3 Q. Yes.

4 DR. CAMPE: And when it comes to
5 calculating the effective area you had to include
6 things like skid area, so yes.

7 Q. Did you include skid areas?

8 DR. CAMPE: In our analysis, yes.

9 Q. So that the number you give in the
10 Consolidated SER for the effective area includes
11 skid areas?

12 DR. CAMPE: Yes, sir.

13 Q. In part of your testimony, also, you
14 were asked about factors that might be used by an
15 Applicant that could affect output. And my
16 recollection is you indicated that use of some
17 factor other than -- I believe you were talking
18 about factors that were not mentioned specifically
19 in 0800. I believe you said something about that
20 would be reasonable if there was a perceived need
21 to use that factor. Do you recall that part of
22 your testimony?

23 DR. CAMPE: Yes.

24 Q. Could you explain what you meant by
25 saying if there was a perceived need?

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1 DR. CAMPE: I'm trying to remember if it
2 was in reference to like the R factor or was it --
3 I do remember the statement, but I don't recall in
4 specifically -- if it was with respect to the R
5 factor, I believe I already explained the fact that
6 in extracting your data, if you want to address a
7 particular population within that database, one way
8 to do it, in the formal sense, is to ascribe a
9 factor that accounts for the fraction of the total
10 that belongs to that particular category. That's
11 what the R factor does. But I'm not sure if that's
12 what you are referring to.

13 Q. I think the testimony was more general.
14 Mr. Soper was asking you about, in general, the use
15 of factors that are not specifically mentioned in
16 NUREG 0800 but might affect the output, as he put
17 it, in terms of the hazard analysis. And you had
18 said something like that would be reasonable if
19 there was a perceived need to use such a factor.
20 That's my recollection of the testimony.

21 DR. CAMPE: My recollection was not so
22 specific as to factors but to any method other than
23 what is written down in the NUREG 0800 formula for
24 this probability, the four-factor formula as we
25 call it here.

1 Q. Well, what did you mean by the use of
2 the term "a perceived need"? Did you mean a
3 perceived need in order to meet the 0800 criteria
4 result?

5 DR. CAMPE: By saying that, I'm trying
6 to express what I cannot speak for somebody else.
7 In other words, an applicant may choose another
8 method for whatever reason they perceive is
9 justified or reasonable in their view. That's what
10 I meant by "perceived need".

11 Q. Thank you. Dr. Ghosh, this may be the
12 only question or one of the few questions I have
13 for you. Mr. Soper, in his questions, asked you
14 about the preliminary analysis that you had done of
15 the proposed Yucca Mountain aircraft crash hazard.
16 And he asked you whether you had mentioned in your
17 document, in your preliminary analysis, any R
18 factor for pilot's ability to avoid. And you had
19 answered no, you did not. And I believe you wanted
20 to explain the reason why you did not. Could you
21 give us that reason?

22 DR. GHOSH: Yes. The Yucca Mountain
23 project is different from the other projects
24 because the Congress gives the pre-licensing
25 activities where the NRC can meet with the

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1 potential applicant, which in this case is the
2 Department of Energy, and do interactions before
3 the application has been submitted to the Nuclear
4 Regulatory Commission. In this way we are trying
5 to do a lot of work beforehand. DOE has already
6 published a report where they did the preliminary
7 analysis and we were reviewing it and trying to see
8 are there any possibilities where they have missed
9 something, they have a defensible letter,
10 defensible assumption, defensible analysis
11 procedures.

12 They used both NUREG methodology and the
13 DOE's own methodology to calculate the probability
14 of crash at the proposed Yucca Mountain site. We
15 just looked into the studies, the NUREG 0800
16 methodology used, in that report as used. As a
17 contractor to the NRC, it is not our job to tell
18 the potential applicant how they should do their
19 analysis. When the actual application comes in, we
20 will look at it and work from their own words.

21 What we did is we just used their
22 report, their letter, their assumption and tried to
23 see whether they could come up with alternate
24 scenarios to show that there is a lack of data,
25 lack of assumptions, whether the basis is

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1 defensible. And that's all we wanted to do in that
2 paper. DOE, that report used the NUREG methodology
3 without the factor to avoid the potential proposed
4 facility. So we use exactly what they have done,
5 try to see other scenarios to see whether their
6 analysis is justifiable or defensible. That's all
7 we want to do.

8 Q. Did the DOE preliminary analysis include
9 an R factor?

10 DR. GHOSH: No.

11 Q. And you didn't suggest that they do?

12 DR. GHOSH: No. It is not our job to
13 suggest to the potential applicant how to do their
14 analysis.

15 Q. Did the Staff suggest to PFS that they
16 should use an R factor?

17 DR. GHOSH: No. We haven't suggested
18 anything to them.

19 Q. You have not suggested anything to them?

20 DR. GHOSH: Haven't suggested that they
21 should use an R factor.

22 Q. Dr. Campe, do you agree with that?

23 DR. CAMPE: Yes, sir.

24 Q. In some questions earlier today,
25 Dr. Campe, Mr. Soper showed you a decision in the

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1 Big Rock Point proceeding and this was LBP 84-32,
2 which is dated August 29, 1984. Do you recall
3 that?

4 DR. CAMPE: Yes, sir.

5 Q. Do you have a copy of that decision in
6 front of you?

7 DR. CAMPE: Yes, I do.

8 Q. I would ask you to turn to -- please
9 turn to Page 38 in that decision under the section
10 titled 5, Cumulative Probabilities.

11 DR. CAMPE: Yes, I have that.

12 Q. And your Honor, this point goes to Judge
13 Kline's question about the 10-6 criterion.

14 I would just ask you to tell me if I am
15 reading the following statement correctly. This
16 appears in the last full paragraph on the page,
17 about midway through the paragraph.

18 The statement begins, and tell me if I'm
19 reading this correctly, "The addition of these
20 probabilities gives a sum of about 2×10^{-6} .
21 Although this sum fails to meet the NRC staff
22 objective of approximately 10^{-7} , we consider $2 \times$
23 10^{-6} to be 'approximately 10^{-6} ' as that acceptance
24 standard is used in SRP Section 2.2.3." And then
25 it goes on. Did I read that statement correctly?

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1 DR. CAMPE: Yes, sir.

2 MR. TURK: Your Honor, and I won't make
3 any argument about that. I merely call it to your
4 attention in your consideration of the 10-6
5 standard.

6 JUDGE FARRAR: Mr. Turk, you said you
7 wouldn't make any argument now.

8 MR. TURK: Yes.

9 JUDGE FARRAR: I assume we will hear a
10 great deal of argument somewhere down the road from
11 all the parties on that.

12 MR. TURK: Our position in the testimony
13 is that the PFS facility meets the Staff's
14 criterion, substantially. I think the number we
15 come up with is a range of, if I'm not mistaken,
16 3.7 to 4.3 times 10-7. That's in the table in our
17 Consolidated SER, so we don't see a need to reach
18 that issue. But it has been a subject of
19 discussion and I wanted to point it out.

20 Q. (By Mr. Turk) Dr. Campe, do you believe
21 that NUREG 0800 excludes or would prohibit the use
22 of an R factor as the Applicant has done here?

23 DR. CAMPE: No, sir.

24 Q. Could you explain that?

25 DR. CAMPE: The way I understand a

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1 factor and the way I understand the expression of
2 the formula in NUREG 0800, if you look at one of
3 the factors that's in question here, the crash rate
4 designated by C in the formula, as it stands there
5 C represents the crash rate of any and all aircraft
6 that may be considered in that given situation
7 without any specificity. If you are going to site-
8 specific considerations, for example, and you want
9 to call out those aircraft that are relevant to a
10 particular crash probability, you can do it at
11 least two ways. You can simply go into the
12 database and by whatever means you choose justify
13 extracting a certain subset that now represents the
14 aircraft that you are focusing on. In this case we
15 are talking about aircraft that are being
16 controlled in a mishap situation, and then have the
17 opportunity for avoidance.

18 Another way to do this is to formalize
19 that step by saying, I will have some crash rate of
20 all the relevant aircraft, call it C prime, and
21 then multiply it by a factor which represents the
22 fraction of that C prime that represents aircraft
23 that are relevant to this particular specific event
24 that you are after. So, in effect, what you are
25 doing is you are saying C equals C prime times R.

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1 And you make a simple transformation and substitute
2 it for C, a quantity, let's say C prime times R.
3 And in that fashion you now formalize an aspect of
4 the analysis and call it a factor R in this case
5 that allows you to talk about how you're extracting
6 the data from the larger set to the subset.

7 Q. So in effect then R is part of the C
8 calculation in the final analysis?

9 DR. CAMPE: That's right, sir.

10 Q. There was some discussion about the
11 extent to which the Air Force constitutes a third
12 party which is not under the NRC's control or the
13 licensee's control. In your experience in
14 evaluating external hazards to a nuclear facility,
15 can you say whether or not all facilities have that
16 same element of uncontrollability of third party
17 factors?

18 DR. CAMPE: By its nature I think it
19 does exist in all types of events that are
20 classified as accidents, whether they are railroad
21 accidents or pipeline explosion accidents, aircraft
22 mishaps. It's a question of degree of what I would
23 call the human factor. There are many factors and
24 one is human factor. If you want to put it on a
25 common basis with what we are talking about here,

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1 name it the R factor. So in that sense, that
2 factor exists in all of these hazards. And
3 typically one takes the view that whatever it is,
4 it is captured by the historical database as such.
5 That is not to say that you can't isolate it,
6 extract it, and treat it separately. But
7 intrinsically all databases capture that factor,
8 along with many other factors.

9 Q. There's been some discussion earlier in
10 the proceeding about the fact that the Staff met
11 with Hill Air Force Base personnel. Were you
12 involved in any of those meetings?

13 DR. CAMPE: Yes, sir. There was a
14 meeting that -- I don't have the specific date at
15 the moment. But it is where we met with Hill Air
16 Force officials at the base as we had a round of
17 questions for clarification and that sort of thing.

18 Q. Do you recall whether, in that meeting,
19 the Applicant's proposed use of this R factor was
20 discussed?

21 DR. CAMPE: It was discussed. I don't
22 recall that it was specifically called the R factor
23 during the discussion. What we were talking about
24 that addressed the R factor was things having to do
25 with pilot behavior in terms of avoidance,

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1 ejection, the circumstances surrounding that sort
2 of thing.

3 Q. And in your discussion of those matters,
4 what sorts of opinions did you come away with based
5 on your discussions with the Air Force personnel at
6 Hill Air Force Base?

7 DR. CAMPE: The basic indication we got
8 from the Hill Air Force personnel was that when it
9 came to an aircraft mishap where there was some
10 degree of control, obviously if a plane was totally
11 disabled there was nothing you can do about it, but
12 in those cases where there was ability to do
13 something as far as aiming the aircraft in some
14 way, first and foremost they would consider any
15 populated or as I recall the words were built-up
16 area would be taken into account as part of their
17 actions as they are going through their checklist
18 trying to restart or any other of the items that
19 they need to do.

20 Q. Did you form an opinion, then, as a
21 result of that discussion as to whether it's
22 reasonable to believe that pilots would attempt to
23 avoid the proposed PFS facility if they were able
24 to do so?

25 DR. CAMPE: I got an overall impression

1 from talking to them about the subject that it was
2 a -- number one, it was something that is, how
3 would you say, in every pilot's mind, attitude,
4 training to consider that. And secondly, that this
5 was not a particularly difficult task to achieve as
6 far as attempting some sort of avoidance. That is
7 not to say that it's easy in each and every case to
8 see where the particular target may be. But
9 insofar as taking any positive action to avoid
10 hitting any populated or built-up areas, that is
11 just part and parcel of what they do. That's the
12 way I walked away from that meeting.

13 Q. Did you conduct any further research of
14 your own in an effort to validate that conclusion
15 or with respect to that conclusion?

16 DR. CAMPE: I have, to some extent. On
17 numerous occasions, as I was pursuing this review,
18 I made it a point to try to find various, and I did
19 find various military web sites sponsored or
20 maintained by the U.S. Air Force in which a
21 discussion of ejections very similar to the kinds
22 that we have been hearing here for the last few
23 days have been described. And I saw on more than
24 one occasion, several occasions in my search,
25 descriptions where pilots under various ejection

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1 scenarios saw and deliberately avoided targets such
2 as populated areas before ejection.

3 Q. Dr. Campe, in the Staff's SER is there a
4 discussion of the Staff's means of treating the
5 pilot avoidance factor?

6 DR. CAMPE: The means of treating the
7 factor?

8 Q. I apologize. I probably wasn't clear.
9 You're familiar with the Staff's Consolidated SER,
10 which is Staff Exhibit C?

11 DR. CAMPE: Yes, sir.

12 Q. Were you principal contributor to the
13 discussion of aircraft crash hazards?

14 DR. CAMPE: Yes, sir.

15 Q. And Dr. Ghosh, you were, as well; is
16 that right?

17 DR. GHOSH: Yes, sir.

18 Q. Does the Consolidated SER contain a
19 discussion of how you evaluated the issue of pilot
20 avoidance?

21 DR. CAMPE: I believe so.

22 MR. TURK: Could we take a moment, your
23 Honor, while we locate the section? May we go off
24 the record for a moment?

25 JUDGE FARRAR: Yes.

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1 (Discussion off the record.)

2 MR. TURK: I appreciate your indulgence
3 in allowing us to take the time to find the
4 relevant passage.

5 Q. (By Mr. Turk) Dr. Campe and Dr. Ghosh,
6 have you had an opportunity to look at the
7 Consolidated SER?

8 DR. CAMPE: Yes.

9 DR. GHOSH: Yes.

10 Q. And I would ask you, in the Consolidated
11 SER, as well as in your testimony, do you discuss
12 the factor that the Staff used in its analysis for
13 R?

14 DR. GHOSH: Yes, we do.

15 Q. And did the Staff use the same R factor
16 quantity that the Applicant used?

17 DR. GHOSH: No. We used a different
18 number.

19 Q. Dr. Ghosh, could you explain -- first of
20 all let's point to where in the SER this is
21 discussed and where in the testimony it is
22 discussed, and then I will ask you to explain on
23 the record how the Staff's calculation of R differs
24 from that of the Applicant.

25 DR. GHOSH: On the testimony it is

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1 Answer 39. On the Consolidated SER on Page 15-67.

2 JUDGE LAM: Mr. Turk, that's the one I
3 gave you.

4 MR. TURK: I'm at a loss because I'm
5 looking at Answer 39 and I don't see it. I was
6 looking at Answer 37, so maybe my understanding of
7 the issue is a little bit off center. Parallel and
8 offset.

9 Q. (By Mr. Turk) Could you please explain
10 the difference between the Staff's calculation of R
11 and that of the Applicant?

12 DR. GHOSH: As I said before, R has two
13 components, R1 and R2. And R1 has two components,
14 Pable to avoid, probability to be able to avoid the
15 site, and Phit, the probability that given all the
16 time and the control, not able to avoid the site.
17 We, for the Phit, we used a value of ten percent.
18 P in the confirmatory calculations we used two
19 values of probability to avoid. For Sevier B we
20 used 90 percent. For Sevier D, which is above the
21 Sevier B, we used a value of 75 percent.

22 Q. And why did you use the 75 percent value
23 for Sevier D?

24 DR. GHOSH: Could you repeat these?

25 Q. Why did you use 75 percent for Sevier D

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1 MOA?

2 DR. GHOSH: I think PFS calculated that
3 out of four mishaps, which probably could have
4 occurred in that -- actually, for probably all of
5 them may not be able -- probably the pilot may be
6 able to avoid, but I think for conservatism --

7 THE REPORTER: I'm sorry. You said
8 probably the pilot may not be able to avoid but I
9 think for conservatism --

10 DR. GHOSH: Probably the pilot may be
11 able to avoid for all the cases --

12 MR. TURK: Would be able to avoid.

13 DR. GHOSH: Would be able to avoid in
14 all cases. But I think there arguably would be
15 difficulty in saying at least one case they would
16 not be able to avoid. So out of one, I mean out of
17 four, it's one. So 75 percent of them.

18 Q. You used a 90 percent value for Sevier B
19 MOA?

20 DR. GHOSH: Yes, sir.

21 Q. And that's compared to, what did the
22 Applicant use?

23 DR. GHOSH: Same 90 percent.

24 Q. Where did you differ in the analysis?

25 DR. GHOSH: The probability-of-hit part.

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1 Q. Could you explain that?

2 DR. GHOSH: Given all the control and
3 the time, the pilot still will not be able to avoid
4 the proposed facility. We used ten percent in
5 comparison to the Applicant's five percent.

6 Q. So, in effect, then, the Applicant used
7 a calculation of 90 percent times 95 percent?
8 Correct?

9 DR. GHOSH: Yes, sir.

10 Q. And the Staff's analysis used 90 percent
11 times 90 percent?

12 DR. GHOSH: Yes, sir.

13 Q. As a result of the Staff's method of
14 calculating the R factor, did you come out with a
15 14.5 percent reduction?

16 DR. GHOSH: Yes. Something above 18
17 percent. It's 18.1 or something.

18 Q. Somewhere above 18 percent?

19 DR. GHOSH: Right.

20 Q. Is that reflected in the Staff's
21 calculation in the Consolidated SER?

22 DR. GHOSH: Yes. That's for the Sevier
23 B. Sevier D is much higher.

24 Q. Because you used the 75 percent?

25 DR. GHOSH: Right.

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1 Q. And that's also reflected in the
2 Consolidated SER?

3 DR. GHOSH: Yes, sir.

4 Q. Dr. Campe, in the Consolidated SER, did
5 the Staff discuss the possibility that information
6 could change in the future with respect to aircraft
7 usage or hazards?

8 DR. CAMPE: Yes, sir.

9 Q. And do you recall the discussion that
10 appeared with respect to future developments?

11 DR. CAMPE: Yes.

12 Q. Is it correct to say, then, that the
13 Staff took into account that there may be future
14 developments and that those might affect the
15 outcome of our conclusions if there were changes
16 that were significant?

17 DR. CAMPE: Yes, we made note of that in
18 the SER.

19 MR. TURK: Your Honor at this point I
20 have nothing further.

21 JUDGE FARRAR: Thank you, Mr. Turk. Mr.
22 Silberg?

23 MR. SILBERG: Yes, I have a few
24 questions. I won't give you a number anymore.

25

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RE CROSS EXAMINATION

BY MR. SILBERG:

Q. A small matter. And I won't address --
I won't address it specifically to either one of
you because I frankly don't remember who these
cross-examination questions were addressed to. But
whoever is the appropriate person.

Mr. Soper, in discussing the loading
rate issue, noted that there were fixed structures
that would be at the PFS facility regarding the
loading rate. Do you recall that question?

DR. CAMPE: Yes, I do. Sir.

Q. A small matter but is there more than
one structure at the PFS facility other than the
casks themselves that would have possibility of
creating a radiological hazard? Isn't it true that
there's only one building of the structures there
that would potentially have a filled cask in it?

DR. GHOSH: Yes, sir.

DR. CAMPE: I'm only aware of two
sources in that sense. One is any loaded casks and
the other is the cask transfer building.

Q. Thanks. Let me ask you a few questions
about the Big Rock decision. First, I think I
understand that the Board determined that the

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1 appropriate rate to use was a rate of 10-10 versus
2 10-11, which was the rate that you had calculated.
3 Is that correct?

4 DR. CAMPE: I believe that's what I saw
5 just recently in looking at it. It was something
6 along the order of 10-10.

7 Q. In any event, either of these rates is
8 specifically more remote than the 10-6 number that
9 we are talking about in this case?

10 DR. CAMPE: Yes. The only thing I want
11 to make sure is that there were more than one type
12 of aircraft involved and whether this encompassed
13 just the military or were there others. That's the
14 only proviso. But those numbers --

15 Q. I believe that the rates that we are
16 discussing were the crash rate for a B-52. Only
17 that particular piece of equipment.

18 DR. CAMPE: That was my feeling, too,
19 but I wasn't sure. I wanted to double check one
20 second.

21 Q. I think if you look on Page 33, second
22 from last paragraph, it talks about, "Dr. Campe
23 then proceeded to calculate a realistic estimate of
24 the probability that the B-52 would crash into the
25 plant."

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1 DR. CAMPE: Right. I see that, yes.

2 Q. The analysis that you have done at PFS,
3 you would characterize that as a conservative
4 analysis as opposed to a realistic analysis?

5 DR. CAMPE: The analysis contains a
6 number of identifiable conservatisms. On the other
7 hand, the use of the R factor is a step towards a
8 more realistic calculation. So there are elements
9 of both. But there are a number of conservatisms
10 in the analysis.

11 Q. And I don't know if you have had enough
12 time to look at the decision itself but if you
13 have, can you comment on the applicability of any
14 of that Licensing Board's criticisms of your
15 methodology with respect to the methodology that
16 you applied in this proceeding? If you haven't had
17 enough time to do that analysis, I fully
18 understand.

19 DR. CAMPE: Without re-reading it
20 carefully, I hesitate to give you an answer that
21 might prove to be misleading.

22 Q. That's fine. Unlike Judge Farrar, I
23 don't think I can remember everything I did even
24 for a case as significant as Richardson versus --

25 JUDGE FARRAR: I hope I can find my car

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1 tonight.

2 Q. Mr. Soper asked you a number of
3 questions about your Yucca Mountain analysis. I'm
4 not sure if Mr. Turk covered it. If he did, I
5 apologize, and I'll withdraw the question. I
6 believe you wanted to explain why the avoidance
7 coefficient was not used in your Yucca Mountain
8 analysis. And if you didn't already answer that,
9 could you please give us the answer?

10 DR. GHOSH: Yes, I already answered.
11 But I can reiterate again.

12 Q. If it's been answered, that's fine.

13 Mr. Soper referred to the "theory of
14 pilots being able to avoid". From what you have
15 heard at the testimony today and your meetings at
16 Hill and your reviewing of the documents, would you
17 characterize pilots being able to avoid as a theory
18 or as something which is actually applied in the
19 real world?

20 DR. CAMPE: To be honest, I don't recall
21 the use of the word "theory". At least I walked
22 away with the recollection Mr. Soper was talking
23 about the concept. But in any event, I would not
24 view it as theory. It is something that is real
25 and obviously, if no one else, the U.S. Air Force

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1 is dealing with it on a daily basis.

2 Q. Thanks. I wrote down "theory". If I
3 misheard, the transcript will reflect it.

4 You had a discussion with Dr. Kline that
5 frankly I didn't understand it and so I will ask
6 you to maybe do it again for my benefit, about
7 using two discount factors, an R and a zero. And
8 you said something about you equated R to zero and
9 I think that went, applying an airplane metaphor,
10 right over my head. Could you go over that again?
11 And maybe I will get it this time.

12 DR. GHOSH: We did an analysis taking
13 the effect of the four-mission flight to the Skull
14 Valley. We assume like, okay, we know that they
15 fly two-ship and four-ship formations. But to be
16 conservative we said, "Okay, if we fly two-ship."
17 But in reality we know that some flights have four
18 ships and they have a staggered pattern. We assume
19 that at least one pilot to be able to hit the site.
20 By knowing they are flying in formation with the
21 distance of 9000 plus feet, the other person will
22 not be able to hit the site. So in effect what we
23 did is taking the R factor for the other pilot
24 equal to zero, because he is not really coming into
25 the picture. And we, in effect, applied the R

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1 factor to the person who is or has some probability
2 of which we assume is uniform throughout the whole
3 Skull Valley width.

4 Q. Now, when you did that, did you continue
5 to count the plane that had the R factor of zero?
6 Or by using an R factor of zero it takes the plane
7 out of the equation?

8 DR. GHOSH: Basically it takes half of
9 the planes out of the equation.

10 Q. Okay. Thank you. I think I understand
11 it now.

12 There were some discussions about Shorum
13 and agreements with radio stations. And this may
14 be something that you don't know. Is it your
15 understanding that the relevant NRC document for
16 emergency planning, NUREG 0654, requires those
17 letters of agreement?

18 DR. CAMPE: I'm not familiar with the
19 NUREG 0654 so I couldn't say if it has any
20 requirement there or not.

21 Q. Okay. Let me give you some suggestions
22 for the Board's interest in how does one follow up
23 on the R factor and ask your views whether these
24 are possible mechanisms. We came up quickly with
25 four possibilities. One would be an annual

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1 briefing by the Air Force on the UTTR to the NRC,
2 either at Hill or the Pentagon. Another would be
3 an oversight panel performing an annual review and
4 producing a report. Oversight panel could be
5 external people to the NRC. It would be academic.
6 Another would be a review and periodic update of
7 the crash risk analysis report. And a fourth might
8 be an NRC site visit to Hill and the UTTR with a
9 subsequent report back to the Commission. Just to
10 get your reaction to those as possible mechanisms
11 if someone thought that, in fact, it was necessary
12 to look at the R factor on a periodic basis.

13 DR. CAMPE: This is instant review on
14 the spot. That's what I'm being asked to do.
15 Which is not normally what I would do.

16 These are all possibilities. To what
17 extent they are workable, I'll be honest, I can't
18 on the spot, without thinking and giving some
19 thought to it and looking into it more deeply, give
20 you any kind of an opinion on it.

21 Q. The Board also asked a number of
22 questions about what could be done in the event,
23 for instance, the flights tripled or new equipment
24 or routes changed. Let me ask you whether one
25 obvious answer wouldn't be that the applicant, the

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1 licensee, could perform the next step of the review
2 which would be a consequences analysis either to
3 determine whether, if anything hit a cask or a
4 canister transfer building, there would be any
5 penetration and therefore any possibility of a
6 release. And second order would be and if there
7 were such penetration, what kind of radiation
8 exposures might you come out with, or might result.
9 Would that be something that could be done as a
10 requirement in the event that major changes
11 occurred in the way that the Skull Valley was used
12 for the Air Force?

13 DR. CAMPE: I don't know about whether I
14 would call it a requirement. It certainly would be
15 well within what is normally an acceptable method
16 of approaching the valuation of any hazard.

17 I go back to the original overview of
18 the aircraft portion of the NUREG 0800 which can be
19 characterized as a screening process, using the
20 methodology described in that chapter. One does
21 have the option of going beyond that to any degree,
22 and it could be from a perfunctory analysis to an
23 in-depth analysis to actual empirical tests, crash
24 tests and things of this nature. I mean, I don't
25 think we are in a position to require anything.

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1 This would be something that the licensee in this
2 case would be in a position to offer as a means of
3 demonstrating that, in spite of the changed
4 conditions, the actual risk is still acceptable
5 because . . . And then the analysis and whatever
6 else would be used to support that.

7 Q. And, in fact, isn't that what the Staff
8 routinely does? Isn't that what's happened in the
9 case of the Calvert Cliffs LNG situation, and the
10 Turkey Homestead Air Force Base situation, tanker
11 traffic down the Ohio River, and the Beaver Valley
12 situation? Hasn't that been done routinely over
13 many decades?

14 A. Yes.

15 Q. In your work reviewing risks, have you
16 had any occasion to look at risks which might
17 result in responses by off-site emergency
18 personnel; police, fire, rescue, et cetera?

19 DR. CAMPE: I recall being involved in
20 looking at that aspect. I'm trying to remember. I
21 believe there's one case that comes to mind is in
22 the review of the Waterford power plant, which is
23 cited in the midst of a very highly industrialized
24 region replete with a number of hazardous
25 materials, notably various chemical facilities and

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1 petroleum and so on. In that case, there was an
2 unusually large number of different types of
3 potential releases of toxic materials which, in the
4 case of a nuclear power plant, is a threat that
5 would impact the control room operators who could
6 be incapacitated.

7 The review eventually led to some
8 provisions, some physical protection provisions in
9 the control room habitability area. But in
10 addition, there was recognition of the fact that by
11 virtue of the existence of this industrial complex,
12 what is, in the state of Louisiana, called a
13 Parish, which is the equivalent of a county in
14 other states, the Parish had a well-equipped,
15 highly organized emergency operations. I don't
16 know if that was the actual name of it, but
17 something to that effect. A war room, if you will,
18 which had communication channels with various local
19 responders, emergency responders, police,
20 ambulances, and so on. And there was a provision
21 made in the license that the control room would
22 have essentially a hot line with this emergency
23 operations center. And you bought a lot of safety
24 through that simple device, because early warning
25 could give you substantial enough time to isolate

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1 the control room ventilation system and take
2 precautionary measures in spite of a release.

3 Q. And so that analysis assumed that those
4 emergency personnel responders in the Parish's
5 control room, if that's in fact in Louisiana, would
6 perform their functions as emergency workers have
7 typically performed their functions over time. Is
8 that correct?

9 DR. CAMPE: I believe so. I don't know
10 the detailed arrangements that were made. But we
11 called out the fact that provision of that sort of
12 procedure would go a long ways in lowering the
13 risk. And then I more or less get out of the
14 picture. The emergency operation people who deal
15 with this got into the detailed arrangements.

16 Q. Now, as far as you know, did the NRC
17 feel any need to determine whether emergency plan
18 emergency personnel would continue the same level
19 of proficiency that they had prior to review? Was
20 there any concern that in the future maybe they
21 wouldn't respond as well?

22 MR. TURK: Specifically with respect to
23 a control room isolation?

24 Q. Yes. With respect to this activity that
25 the NRC was looking at.

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1 DR. CAMPE: I don't know of any specific
2 things about that other than as an established
3 center that operates for its own mission of
4 protecting the public, because they are in a
5 hazardous area to begin with. And this was just
6 merely an addition of a communication channel. And
7 I guess it's in the form of an agreement, I don't
8 know the exact nature, where they know the nuclear
9 plant is there. The nuclear plant knows the
10 emergency operation center is there, and the
11 procedure calls for communication and an alert. In
12 fact, I believe it worked both ways. The
13 operations center would be also immediately
14 notified if anything was amiss at the nuclear
15 plant.

16 Q. I have no further questions.

17 JUDGE FARRAR: Mr. Soper, any recross?
18

19 RECROSS EXAMINATION

20 BY MR. SOPER:

21 Q. Very brief. Dr. Ghosh, sir, you are
22 aware, are you not, that the Applicant's
23 application without the use of the R factor for
24 aircraft crash probability would exceed 1×10^{-6} ?

25 DR. GHOSH: Yes, if we use the NUREG

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1 methodology where we distribute all the aircraft
2 throughout the width of the Skull Valley. But if
3 we take variability that generally they do not fly
4 towards -- they fly towards the eastern side of the
5 border, we may have a different picture.

6 Q. So you are aware that this is a huge
7 impact, so to speak; this use of this R factor?

8 DR. GHOSH: At one point. But at the
9 same time, we have taken a huge conservatism by
10 putting the aircraft throughout the whole width of
11 it.

12 Q. Dr. Campe, did I understand you, sir, to
13 say that the ability of a pilot to avoid a ground
14 site is captured in historical data?

15 DR. CAMPE: Yes.

16 Q. And does that mean that it's built into
17 the crash rate or what does that mean, exactly?

18 DR. CAMPE: I simply mean that when I
19 look at historical data, what events have happened
20 of any kind, then all the factors, the causative
21 factors, that were involved in that event are
22 intrinsically tied to that event. The heart of
23 that event.

24 Q. Tell me, sir, how you could glean any
25 notion of a pilot's ability to avoid anything from,

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1 for example, the historical crash rates which
2 include crashes regardless of what the pilot did
3 before the aircraft crashed?

4 DR. CAMPE: How I do that? I think I
5 understand what you are getting at. If you have an
6 event that's part of your database, how do you
7 determine to what extent an R factor was involved
8 in that event, the avoidance and that sort of
9 thing?

10 Q. You are telling me it is already
11 captured in the data.

12 DR. CAMPE: It is captured but that
13 doesn't mean I know how to get at it.

14 Q. So the fact that it is captured is of no
15 practical value in your analysis, is it?

16 DR. CAMPE: It can be.

17 Q. Tell me how it would be in this case.

18 DR. CAMPE: If you find a means of
19 extracting that information from that data, then it
20 is do-able.

21 Q. Without finding the means to extract it,
22 the fact that it is captured is not helpful, is it?

23 DR. CAMPE: No. If you can't extract
24 it, it is of no use.

25 Q. And in this particular case, it seems to

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1 me the only way of extracting it is to specifically
2 inquire as to the facts of each accident and then
3 cull through those facts and make some sort of
4 determination. Wouldn't that be correct?

5 DR. CAMPE: I don't know if that's the
6 only method. But that was the method that was used
7 here.

8 Q. Do you know of another method?

9 DR. CAMPE: I personally don't.

10 Q. That's all I have. Thank you, your
11 Honor. Thank you, gentlemen.

12 JUDGE FARRAR: I take it those questions
13 don't create any need to go around again?

14 MS. MARCO: No.

15 MR. SILBERG: Mercifully no, for the
16 Applicant.

17 MR. TURK: No for us, your Honor.

18 JUDGE FARRAR: Gentlemen, thank you very
19 much for your testimony. You are excused unless
20 Mr. Turk wants to recall you tomorrow morning.

21 MR. TURK: Thank you.

22 DR. GHOSH: Thank you.

23 DR. CAMPE: Thank you.

24 JUDGE FARRAR: It is seven o'clock. Mr.
25 Soper -- now, that's all for the Staff, right?

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1 MS. MARCO: That is it. That's it, yes.

2 JUDGE FARRAR: Mr. Soper, how long will
3 it take to get Colonel Horstman sworn in and
4 exhibits marked and so forth? Is that fairly
5 brief?

6 MR. SOPER: I haven't been recalling
7 from the other witnesses but I assume about the
8 same. We don't have anything extraordinary.

9 JUDGE FARRAR: We had trouble the first
10 day with the first panel, but this should be easy.
11 All right. Trying to make a decision now for the
12 parties in terms of their travel. Mr. Turk, and
13 Mr. Silberg, how much cross? Hold on.

14 MR. SILBERG: I'm trying to retrieve the
15 people with that information.

16 JUDGE FARRAR: Mr. Soper, are you
17 putting on a panel or one at a time?

18 MR. SOPER: Probably one at a time, your
19 Honor.

20 JUDGE FARRAR: Then we--

21 MR. TURK: Ms. Marco will do the
22 cross-examination for the Staff, and she indicated
23 she has very little. Just a small amount.

24 JUDGE FARRAR: For both?

25 MS. MARCO: For both.

1 MR. SILBERG: I think we probably have a
2 substantial amount, but whether it's as substantial
3 as two hours or ten hours, I don't know. Paul
4 probably can give you that information.

5 JUDGE FARRAR: Of the two, Mr. Gaukler,
6 of the two State witnesses, cross will take how
7 long? And be realistic because people tonight can
8 make their travel plans or not.

9 MR. GAUKLER: I would say, taking into
10 account board questions and questions of redirect,
11 I would guess at least a day.

12 JUDGE FARRAR: So we don't know that we
13 can finish tomorrow.

14 MR. GAUKLER: My goal would be to finish
15 tomorrow, but I don't know.

16 JUDGE FARRAR: We don't know.

17 MR. BARNETT: With cross, you mean?

18 MR. GAUKLER: With cross, right. Finish
19 with these witnesses other than rebuttal. Is what
20 you are talking about, right?

21 JUDGE FARRAR: Rebuttal?

22 MR. GAUKLER: Finishing with the State's
23 witnesses.

24 JUDGE FARRAR: Right. And then you
25 anticipate after them you might have rebuttal?

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1 MR. GAUKLER: Possibly, yes.

2 JUDGE FARRAR: That would be your
3 previous panel, or some other people?

4 MR. GAUKLER: Previous panel.

5 JUDGE FARRAR: Our plan is, if we don't
6 finish tomorrow, to come back Monday.

7 MR. GAUKLER: General Cole has a problem
8 with Monday.

9 GEN. COLE: I can't do it. I leave
10 Sunday.

11 JUDGE FARRAR: What's the alternative?

12 MR. GAUKLER: General Cole rearranged a
13 meeting originally to make this meeting available.
14 He has a meeting next week.

15 JUDGE FARRAR: I don't mind that he is
16 not available. What's the alternative to meeting
17 Monday?

18 MR. GAUKLER: He is gone basically three
19 weeks, so the alternative would be the week of May
20 13th. Because after next week he is out of the
21 country for two weeks and then we are into the
22 seismic.

23 JUDGE FARRAR: So it is not Monday
24 versus Tuesday versus Wednesday.

25 MR. GAUKLER: Right.

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1 MR. SOPER: If it would be of
2 assistance, I think we could make arrangements to
3 get in here Sunday.

4 JUDGE FARRAR: Great. I was told we
5 couldn't. Sharon, do you know anything about that?
6 Off. Off the record.

7 (Discussion off the record.)

8 JUDGE FARRAR: It appears -- well, can
9 you do -- are you concerned about him as a rebuttal
10 witness or him being at your side as an advisor?

11 MR. GAUKLER: Probably more concerned as
12 a rebuttal witness.

13 JUDGE FARRAR: Well, we had deliberately
14 set aside the sixth week --

15 JUDGE LAM: Sixth day.

16 JUDGE FARRAR: A sixth week in May for
17 anything we didn't finish in any of the other
18 sessions, so that's what we would fall back on.

19 MR. SILBERG: For what it's worth, and
20 I'm speaking out of school for everybody. I don't
21 know, and maybe we can do it off the record.

22 JUDGE FARRAR: Okay. Let's go off.

23 (Discussion off the record.)

24 JUDGE FARRAR: Back on the record. It
25 took a while but we have the building until 11:00

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1 but we are going to keep going until the first
2 person drops or has to leave, and then we will call
3 it an evening. Keeping the same reporter here
4 means you are not going to get her portion of the
5 transcript on time tomorrow morning. But she
6 couldn't get anybody else to come in. So you will
7 get the earlier portions tomorrow and have to wait
8 for hers until later. All right. Let's then move
9 right along with the State's testimony. And let
10 the record reflect that I do not see anyone eating
11 in this courtroom. Mr. Soper, you can begin with
12 your witness.

13 MR. SOPER: Ms. Nakahara is going to
14 introduce the testimony, if that's okay.

15 JUDGE FARRAR: All right. Mr. Gaukler,
16 you still had exhibits to get in. If we run into a
17 place where we need some time for counsel to do
18 something else, maybe we will use that for
19 housekeeping or whatever.

20 MR. GAUKLER: Okay.

21 MS. NAKAHARA: What I have provided to
22 you and the parties, and three copies for the court
23 reporter, is a revised testimony for Lt. Colonel
24 Hugh Horstman pursuant to their decision on motions
25 in limine on Monday. Yesterday the parties were

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:

PRIVATE FUEL STORAGE, LLC
(Independent Spent Fuel
Storage Installation)

)
)
)
)
)

Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

~~February 19, 2002~~ April 10, 2002

STATE OF UTAH'S PREFILED TESTIMONY OF
LIEUTENANT COLONEL HUGH HORSTMAN (U.S.A.F. RETIRED)
REGARDING CONTENTION UTAH K/CONFEDERATED TRIBES B

I. BACKGROUND AND QUALIFICATIONS

Q. 1: Please state your name and residence.

A. 1. My name is Hugh Horstman. I live in Layton, Utah.

Q. 2: By whom are you employed and what is your position?

A. 2. I am currently a Boeing 737 pilot for Southwest Airlines as well as an Adjunct Professor at Embry Riddle Aeronautical University, where I instruct masters degree candidate students in aviation.

Q. 3: Please describe your professional background.

A. 3. I have more than 20 years experience as a pilot in the U.S. Air Force with over 2,500 hours as a pilot and over 1,000 hours as a navigator. I have over 1,800 hours flying F-16 and F-111 fighters. I was an instructor pilot for both the F-16 and F-111 fighter aircraft and, in addition, an instructor navigator. I also taught masters level aeronautical courses to Air Force officers for Embry Riddle Aeronautical University while I was in the Air Force. I earned a B.S. degree in business from the University of Southern California and a M.A. degree in business from Central Michigan University. A copy of my curriculum vitae is included with this testimony as State's Exhibit 38.

Q. 4: Please describe your background with respect to the Utah Test and Training Range.

A. 4. From October 1997 through June 1999, I served as Deputy Commander, 388th Operations Group, Hill Air Force Base, Utah. In this position, I commanded the F-16 Operations Group and 1,500 personnel. The Operations Group was responsible for the administration of all 388th Fighter Wing flying activity, including the sorties flown in the Utah Test and Training Range ("UTTR") airspace. The Operations Group was also responsible for managing the UTTR air space and for managing the three fighter squadrons stationed at Hill Air Force Base. In addition, I was responsible for the flight line maintenance of all 60 F-16C aircraft assigned to the 388th Fighter Wing.

From June 1993 through September 1997, I was stationed at Spangdahlem Air Base, Germany. I served as Deputy Commander of the 52nd Support Group, Chief of the 52nd Fighter Wing Readiness, and Assistant Operations Officer of the 22nd Fighter Squadron. As

Assistant Operations Officer, I was, in part, responsible for ensuring that all F-16 pilots in my fighter squadron were combat ready and fully trained. As Chief of Fighter Wing Readiness, part of my responsibility included preparing training scenarios for 100 F-16s, F-15s, and A-10s and serving as a flight instructor. As Deputy Commander of the Support Group, I served as a flight instructor in addition to my other duties.

Q. 5: Please describe your familiarity with the UTTR.

A. 5: I flew over 150 training missions in the UTTR during the twenty months I was stationed at Hill Air Force Base ("AFB") and I am intimately familiar with the UTTR land and air space, including its various military operating areas ("MOAs"). I flew an average of two training missions per week while stationed at Hill AFB. In addition, while stationed at Hill AFB I was responsible for planning training missions and instructing F-16 pilots. I flew training missions as an instructor pilot, as a flight lead, and as a mission commander. In those capacities I was responsible for assessing individual pilot performance on various tasks, including emergency procedures. I was qualified to fly and did fly all missions out of Hill AFB, including air-to-air combat missions, air-to-ground combat missions (e.g., precision ordinance bombing), low level training missions, targeting pod, and night vision goggle missions.

II. PURPOSE OF TESTIMONY AND DOCUMENTS REVIEWED

Q. 6: Are you familiar with Contention Utah K and what is your understanding of the issues remaining in Utah K?

A. 6: Yes, I am familiar with Utah K. I have been assisting the State on this issue since 2000. The remaining issues in Utah K concern the probability and extent of damage from aircraft crash impact at the proposed Private Fuel Storage, L.L.C. ("PFS") facility from F-16 aircraft transiting Skull Valley, F-16 and other aircraft conducting air-to-air training exercises on the UTTR, F-16 aircraft returning to Hill AFB from the UTTR via the Moser Recovery Route ("MRR"), military aircraft flying in military airway IR-420 to and from Michael Army Airfield, and crash impacts from military ordnance.

Q. 7: What is the purpose of your testimony?

A. 7: The purpose of my testimony is to provide expert opinions and otherwise testify concerning the extent and nature of F-16 and other military flights in the UTTR and Skull Valley, and the characteristics of the F-16 aircraft and the capabilities of F16 pilots as

those issues relate to the proposed PFS facility and Contention Utah K. My testimony includes matters relating to the number of flights in the vicinity of the PFS facility; the nature of the flights and their missions; the weather encountered in the area; pilot performance in emergency situations, such as ejection; the F-16 crash rate; the purpose and interpretation of mishap reports and their unreliability as future predictors of whether pilots can avoid a specific ground site; and whether assumptions and values relied on by PFS in connection with its analysis of impacts from aircraft crashes are correct and conservative.

Q. 8: Are you familiar with the PFS license application filed in this proceeding and the proposed location of the PFS facility?

A. 8: Yes. I understand that PFS plans to build a large facility to store commercial spent nuclear fuel from reactors located across the country, and to store the spent nuclear fuel in concrete storage casks located on concrete pads and exposed to view. I am generally familiar with the rough dimensions of the facility and the size and material of the storage casks. Furthermore, having flown numerous training missions over Skull Valley, I am very familiar with the proposed location of the PFS facility – the northwest corner of the Skull Valley Reservation.

Q. 9: What documents have you reviewed with respect to this contention?

A. 9: I have reviewed PFS's license application to include pertinent sections of the *Safety Analysis Report* ("SAR") and subsequent SAR revisions dealing with "Hazards From Air Crashes." I have reviewed Revision 2 dated June 6, 2000, Revision 3 dated June 17, 2000, and Revision 4 dated August 10, 2000 of PFS's *Aircraft Crash Impact Hazard Report* ("Crash Report"), and Addenda thereto (dated January 19, 2001 and July 20, 2001). I have also reviewed the applicable portions of NRC's final *Safety Evaluation Report* (September 29, 2000) and the *Supplemental Safety Evaluation Report* (November 13, 2001). I am generally familiar with NRC regulations and guidance documents relating to the calculation of aircraft hazards, including NUREG-0800. I have reviewed the U.S. Air Force Accident Investigation Reports for F-16s obtained by the State from PFS. Further, I have reviewed various data, manuals, directives, and memoranda issued by the U.S. Air Force, including F-16 crash rates, F-16 procedural manuals, and SAFECOM directives. I have also reviewed weather related data from Michael Army Airfield located at Dugway Proving Ground, Utah. Further, I have reviewed the Air Force instruction on preparing accident reports, specifically AF Instruction 51-503, *Aircraft, Missile, Nuclear, and Space Accident Investigations*.

In addition, I have reviewed the Applicant's Motion for Summary Disposition of

Utah Contention K and Confederated Tribes Contention B – Inadequate Consideration of Credible Accidents (“Utah K”) filed December 20, 2000, including the Joint Declaration of James Cole, Wayne Jefferson, and Ronald Fly (Joint Declaration, State’s Exhibit 39), and the declaration of Stephen A. Vigeant. I have also reviewed the deposition transcripts of State expert witness Dr. Marvin Resnikoff and PFS witnesses James Cole and Ronald Fly. I was present at the deposition of PFS witness, Ronald Fly. I have reviewed Dr. Resnikoff’s pre-filed testimony in this matter and various other related documents.

III. F-16 AIRCRAFT TRANSITING SKULL VALLEY

A. The nature of the airspace and the aircraft flights above Skull Valley.

Q. 10: Please describe the UTTR air space and the military activities that occur within the air space.

A. 10: The UTTR or Utah Test and Training Range, located in Utah’s west desert, is comprised of both an on-ground training range and training airspace. See State’s Exhibit 40, map showing a portion of the UTTR. The UTTR range and the UTTR airspace are defined by different boundaries. Skull Valley is located below the UTTR airspace while the UTTR South range is defined by on-the-ground boundaries that do not include Skull Valley.

The UTTR airspace is the largest overland special use airspace in the continental United States and the largest overland safety footprint available to the U.S. Department of Defense. See State’s Exhibit 41, UTTR Capabilities Guide excerpt at 3. The UTTR is a unique and valuable asset to the U.S. military, and its continued use as a military training and testing area is vital to military training and the national security of the United States.

The Sevier B Military Operating Area is part of the UTTR airspace over Skull Valley. See State’s Exhibit 42, Annual Military Operating Area Usage Report for Sevier B MOA. Military low altitude training, air-to-air combat training, major exercises, and cruise missile testing are authorized and conducted in this airspace. See also Exh. 40, and State’s Exhibit 43, Map of IFR Enroute Low Altitude - U.S., effective May 20, 1999, showing locations of Sevier B and D MOAs.

Portions of Sevier D MOA are also part of the UTTR airspace over Skull Valley. See State’s Exhibit 44, Annual Military Operating Area Usage Report for Sevier D MOA; see also State’s Exh. 43. Major exercises and cruise missile testing are authorized in the Sevier D MOA.

Additionally, the portions of the UTTR airspace over the UTTR range are designated "restricted airspace." See Map, State's Exh. 40. Airspaces designated as R-6402 and R-6406, located near the proposed PFS facility, are authorized for air-to-ground bombing, air-to-air training, and major exercise deployment in the restricted UTTR airspace. See State's Exhibit 45, Separate Annual Military Operating Area Usage Reports for R-6402A, R-6402B, and R6406, dated November 30, 1998.

Q. 11: Please describe the boundaries of the Sevier B MOA and their locations relative to the proposed PFS facility.

A. 11: The Sevier B MOA begins at an elevation of 100 feet above ground level and extends to 9,500 feet above mean sea level (approximately 5,000 feet above ground level). See State's Exh. 42. The proposed PFS facility is located under the Sevier B MOA.

Q. 12: Please describe the boundaries of the Sevier D MOA and their locations relative to the proposed PFS facility.

A. 12 The Sevier D MOA begins at an elevation of 9,500 feet mean sea level (approximately 5,000 feet above ground level) and extends to Flight Level 180 (approximately 13,750 feet above ground level). See State Exh. 43. The proposed PFS facility is located under the Sevier D MOA.

Q. 13: Please describe the boundaries of the UTTR restricted airspace and their locations relative to the proposed PFS facility.

A. 13: The proposed PFS facility will be located two miles from restricted airspaces R-6402 and R-6406. See Crash Report at 28.

Q. 14: Do you have an opinion on whether the U.S. Air Force will continue to use the UTTR airspace and if so, what is your opinion?

A. 14. Yes, it is my opinion the U.S. Air Force is likely to continue its present use or increase its use of the UTTR airspace, including the airspace over Skull Valley. See also State's Exhibit 46, Statement by Utah First District Congressman, Representative James V. Hansen, Limited Appearance Session, Salt Lake City, June 23, 2000, Tr. 13-17.

Q. 15: What F-16 formations are flown in Skull Valley?

A. 15: Typically, F-16s fly in two or four aircraft formations. Each formation is led by a flight leader. The positions of the aircraft vary depending upon the selected formations. In a two ship formation, the wingman would fly 1.5 to 2 miles, line abreast, from the flight leader at a position 0 to 10 degrees aft (or "abeam") of the leader's flight path.

In a four ship formation, a wingman would fly 1.5 to 2 miles line abreast from the flight leader. Those two aircraft (lead and wingman) comprise the "lead element." Two additional aircraft with similar line abreast spacing to the lead element will follow 2 to 15 miles behind the lead element. One of the aircraft in the back element will be located between the horizontal spacing of the lead element (2 to 15 miles back). The back element will be offset from the lead element to the left or right wing. Thus, a four ship formation may vary from just over 1.5 to just under 4 miles in horizontal width and over 2 to 15 miles long.

Q. 16: What is the typical flight path for F-16s transiting Skull Valley?

A. 16: Most flights are in the Sevier B MOA. Due to the flight path from Hill AFB and the physical layout of Skull Valley, a flight will enter Skull Valley heading in a southwest to south direction, and will then turn south to southeast. Thus, the natural and typical flight path of an F-16 formation is essentially down the middle of Skull Valley with part of the formation flying over or near the proposed PFS site, because the formation must maintain a safe distance from the Stansbury Mountains to the east and restricted airspace to the west.

Q. 17: Describe the width of the Sevier B MOA airspace used by F-16s at the latitude of the proposed PFS facility site.

A. 17: The Sevier B MOA is 12 miles wide at the latitude of the proposed PFS facility site, as shown by State's Exhibit 47, Figure one of the PFS Crash Report. The Stansbury Mountains encroach approximately 3 miles into the Sevier B MOA at the latitude of the PFS facility, eliminating the most easterly 3 miles of the MOA airspace. The flight leader will select a flight path to allow the furthest east aircraft in the formation to retain a sufficient distance (generally two miles) from the Stansbury Mountains. Therefore, the furthest east ship in a formation will be 5 miles from the eastern boundary of the Sevier B MOA.

The flight leader will also select a path to allow the furthest west aircraft in the formation to keep a one mile distance from the western boundary of Sevier B MOA, beyond

which is restricted airspace. Therefore, the width of the Sevier B MOA airspace over the PFS facility that is actually used by F-16s extends from a point one mile east of the western boundary of the MOA to a point 5 miles west of the eastern boundary of the MOA, or a width of approximately 6 miles. Within this 6 mile width of usable airspace, F-16s fly in 2 or 4 ship formations which are from 1.5 to just under 4 miles wide. With one ship in the formation flying at either the east or west edge of the usable airspace, the remaining ships in the formation would be inward from the edges of the usable airspace. Therefore, the majority of F-16 flights in Sevier B MOA are in a corridor less than five miles wide located within the 6 mile width of usable airspace. The airspace I have described is illustrated in State's Exhibit 48 as an overlay to Figure One of the Crash Report.

Q. 18: The PFS Crash Report states that the predominant route of F-16s transiting Skull Valley is along the edge of the Stansbury Mountains "approximately 5 statute miles east of the PFS site." Is that statement consistent with your testimony that F-16s fly over the proposed PFS facility site within a corridor less than 5 miles wide?

A. 18: As I testified in my foregoing answer, the maximum width of the Sevier B MOA airspace over the PFS facility site that is actually usable is approximately 6 miles wide. The eastern edge of that usable airspace at the latitude of the PFS facility is five miles west of the eastern boundary of the Sevier B MOA, and is also 5 miles east of the PFS facility site. Therefore, the F-16 "route" described by the PFS Crash Report is approximately the same as the eastern boundary of the usable airspace that I have described. Consequently, with formations of 2 to 4 ships where the furthest east ship is flying five miles east the PFS facility site, all aircraft would be within the six mile usable airspace that I described. Also, all ships except the one furthest east in the formation would be inward from the eastern edge of that airspace. Thus, most F-16s would be in a corridor of less than five miles in width, consistent with my testimony.

However, I do not agree that F-16 formations would predominately use a flight path where the furthest east ship is approximately 5 miles east of the PFS facility site. Although such a flight path is within the 6 miles width of usable Sevier B MOA airspace, the actual flight path is dependent upon the flight training mission and flight leader. Based on my personal experience, F-16 formations are just as likely to use other portions of that usable airspace.

Q. 19: Will there be any change in the flight path of F-16s through Skull Valley if the proposed PFS facility is built?

A. 19: If the PFS facility is built, F-16s will continue to fly in a corridor of less than 5 miles wide as I have described, but they will fly in greater concentration over or near the PFS facility site. This is because many pilots will use the PFS facility on clear or cloudy days as a turning or navigation point because of its finite features. A turning or navigation point is used to update the aircraft's internal navigation system. During this process a pilot essentially points the aircraft at the navigation point, in this case, the PFS facility. Pilots update their navigation equipment during each training mission before entering the UTTR.

Pilots also use turning points to map out a flight path, and pilots practice using turning points on every mission. As a result, more F-16s will fly directly over the PFS facility site if the facility is built.

Q. 20: What type of flights are flown through Skull Valley?

A. 20: F-16s originating from Hill Air Force Base regularly transit Skull Valley using the Sevier B MOA or the Sevier D MOA en route to the UTTR South Area range. F-16s conduct low altitude training in Skull Valley, and practice terrain masking using either the Stansbury Mountains to the east or the Cedar Mountains to the west. F-16s may also perform G awareness turns, clearing turns, tactical turning maneuvers, aircraft orientation, fence checks, systems calibration checks, visual navigation radar updates, or turning points while transiting Skull Valley.

Q. 21: Please describe "low altitude training" that occurs in Skull Valley.

A. 21: A pilot conducting low altitude training typically flies from 1,000 to 2,000 feet above ground level ("AGL"). Low altitude training may occur at lower altitudes. I have conducted low altitude night training ("LANTIRN") at levels of 500 to 600 feet above ground level through Skull Valley.

Q. 22: Please describe "terrain masking."

A. 22: Terrain masking is the use of a geological feature, such as mountains, to prevent radar detection of the aircraft by flying below the ridge line of the feature. The position of F-16s in Skull Valley during terrain masking is dependent upon the hypothetical location of the radar. The hypothetical location of the radar varies with each training mission and flight. I have used both the Cedar Mountains and Stansbury Mountains to conduct terrain masking exercises while transiting Skull Valley. Thus, my terrain masking

flight paths through Skull Valley have occurred over the eastern, middle and western portions of the valley.

Q. 23: Please describe “G awareness turns,” “tactical turning maneuvers,” and “clearing turns.”

A. 23: In performing a G awareness turn, a pilot would perform a 90 degree turn at approximately a four G force, roll out, then perform another 90 degree turn back to the original heading. A G awareness turn is performed to test the pilot’s physical capability to encounter G forces.

A tactical turning maneuver is performed at tactical airspeeds while in a formation. Tactical turns are aggressive turns at 3 to 4 Gs, designed to be as brief as possible. In a tactical turn the wingman’s position relative to the flight leader must be achieved as quickly as possible after completion of the turn. The purpose of the tactical turn is for each flight member to provide visual mutual support to other flight members for as much time as possible. Flight members that are positioned behind or directly above are not able to provide visual mutual support.

A clearing turn is a less aggressive maneuver than a tactical turn. Clearing turns may be performed in formation or by a single aircraft. A clearing turn is designed to “clear” the visual flight path of the aircraft.

Q. 24: Are the F-16 flights conducted over Skull Valley considered “low risk”?

A. 24: No. Because of the speed, altitude and nature of the missions flown in Skull Valley, they would be considered “high risk” activities, although of a lower risk than combat activities.

Q. 25: At what altitudes do F-16s fly through Skull Valley?

A. 25: F-16s most commonly fly through Skull Valley at 3,000 feet AGL in the Sevier B MOA but may fly in or above the Sevier B MOA up to 18,000 feet AGL. I often flew above the upper boundary of Sevier B MOA when transiting Skull Valley. The altitude of F-16s transiting through Skull Valley is dependent upon the decision of the flight leader and the specific training mission. Based on my personal experience, F-16s fly over Skull Valley at altitudes ranging between 500 to 18,000 feet AGL, although flights below 1,000

feet AGL are now limited.

Q. 26: Please describe the terms “visual flight rules” and “instrument flight rules”?

A. 26: For a pilot to fly under visual flight rules (“VFR”), a pilot must have at least 5 miles of visibility in front of the aircraft. In addition, the aircraft must be “clear of clouds” which means that the aircraft must be at least 1,000 feet above clouds and at least 500 feet below clouds. A pilot may fly under VFR either above or below clouds. I have flown many times above cloud cover through Skull Valley.

For a pilot to fly through Skull Valley in IFR conditions means that the pilots’ visual acuity is limited by weather phenomenon to less than VFR conditions. With less visibility than VFR conditions a pilot is required to fly in instrument flight rules which requires a ground radar controller to issue instructions.

Q. 27: Are all flights above the Sevier B MOA flown under instrument flight rules?

A. 27: No. Depending upon the weather, F-16 pilots may fly above the Sevier B MOA under either visual flight rules or instrument flight rules. I have piloted an F-16 above the Sevier B MOA under visual flight rules many times.

Q. 28: Are all flights in the Sevier B MOA flown under visual flight rules?

A. 28: No. Pilots can and do fly F-16s through the Sevier B MOA under instrument flight rules as well as visual flight rules.

Q. 29: How fast do F-16s fly through Skull Valley?

A. 29: Typically, F-16s fly through Skull Valley at “tactical speed” or 400 to 450 knots indicated air speed (“KIAS”). F-16 pilots may fly faster than “tactical speed,” and typically fly at 400 to 450 KIAS when performing a G awareness exercise. F-16 pilots do not normally fly through Skull Valley at speeds of less than 400 KIAS and such speeds would neither be typical nor average. A speed as low as 350 KIAS would be unusual because at that speed the aircraft is significantly less maneuverable than at 450 KIAS. A pilot would fly at 350 KIAS for only a brief period in order to gather the formation or adjust timing.

Q. 30: What is your opinion as to the annual number of flights transiting Skull Valley?

A. 30: Flights through Skull Valley include flights in the Sevier B MOA and in and above the Sevier D MOA. The number of annual sorties flown in Sevier B and D MOAs in recent years is:

<u>FY</u>	<u>Sevier B MOA</u>	<u>Sevier D MOA</u>	<u>Total</u>
FY1998	3,871 sorties	215 sorties	4,086 sorties
FY1999	4,240 sorties	336 sorties	4,576 sorties
FY2000	5,757 sorties	240 sorties	5,997 sorties

This figures are shown at page 4 of the Revised Addendum to PFS's Crash Report (July 20, 2001).

Also, twelve additional F-16 fighters have been assigned to the 388th Fighter Wing at Hill AFB, increasing the 388th total from 54 to 66 F-16s. See State's Exhibit 49, news report. The 419th Reserve Fighter Wing consisting of 15 F-16s continues to be stationed at Hill AFB. The total number of F-16s assigned to the 388th Fighter Wing and the 419th Reserve Fighter Wing has therefore increased from 69 to 81, or 17.4%. The additional F-16 fighters will increase the number of training sorties proportionally. See, Cole, et al Joint Dec. ¶ 27. It should be noted that these numbers do not account for sorties flown above both Sevier B and D MOAs in Skull Valley. As I testified, I have flown many times above both MOAs while transiting Skull Valley.

Q. 31: What is your opinion as to whether the determination of annual sorties through Skull Valley made by PFS and used in its Aircraft Crash Impact Report and SAR was correct and conservative?

A. 31: Even though the total number of sorties for Sevier B MOA has increased each year from FY1998 to FY2000, PFS states that it would be "improper" to use the number of sorties in FY2000 because of fluctuations caused in part by a deployment policy known as the Air Expeditionary Force ("AEF"). In fact, the 388th fighter wing at Hill AFB has been involved in AEF deployment since July 7, 1997, as shown on State Exhibit 69. Any actual effect on the number of Skull Valley flights due to the AEF concept is reflected in the actual flight data for FY1998 through 2000. The AEF concept provides no reason

why the single year FY2000 would reflect artificially high sortie numbers and no reason has been offered by PFS.

PFS determined the annual number of sorties through Skull Valley to be 5,870, arrived at by taking the average of FY1999 and FY2000 sorties for Sevier B MOA only, increased by the proportion of additional F-16s assigned to Hill AFB, 17.4%. The lower number of sorties used by PFS has already been exceeded by the total flights in Sevier B and D MOAs for FY2000, even without considering that twelve additional F-16s have been assigned to Hill AFB. The number of sorties used by PFS will likely be exceeded over the 40 year life span of the proposed PFS facility.

The expected number of F-16 annual sorties flown through Skull Valley in the Sevier B MOA and Sevier D MOA in the future should therefore be estimated to be a minimum of 7,040 annual sorties -- that is, a 17.4% increase to account for the additional twelve F-16s over the 5,997 sorties flown in Sevier B and D MOAs in FY2000. Even the 7,040 number is not conservative because it does not account for the trend of increasing annual sorties and does not consider sorties flown through Skull Valley above the Sevier B and D MOAs.

PFS's failure to consider the sorties flown above Skull Valley in Sevier D MOA, failure to consider the number of annual flights through Skull Valley above Sevier B and D MOAs, and failure to account for the trend of increasing annual flights through Skull Valley make PFS's determination of 5,870 annual sorties through Skull Valley neither a realistic nor conservative estimate of present or future flight activity.

B. Crash Rates for F-16 Aircraft.

Q. 32: Are you familiar with the crash rates for the F-16 aircraft?

A. 32: Yes. The Air Force publishes the F-16 crash statistics; included as State's Exhibit 50 are crash statistics through FY 2000. There are separate crash statistics for each version of the F-16 (F-16A, F-16B, F-16C, F-16D, and F-16 GLOC) and crash statistics for all versions combined.

The F-16 crash rates for FY1976 to 1993 are also contained in the *Data Development Technical Support Document for the Aircraft Crash Risk Analysis Methodology ("ACRAM") Standard*, by Chris Y. Kimura, et al, Lawrence Livermore National Laboratory, August 1, 1996, UCRL-ID-124837. The ACRAM crash rates have been separated for F-16 normal flight and special

operations, as are shown on table 4.8. See State's Exhibit 51, excerpts from ACRAM. The manner in which the data was derived is discussed in ACRAM pages 4-1 through 4-6, State's Exh.51.

Q. 33: What factors should be considered in predicting future F-16 crash rates for use in evaluating aircraft crashes impacts to the proposed PFS facility?

A. 33: There are extreme variances in crash rates over the service life of a fighter aircraft. Fighter aircraft experience particularly high crash rates at the beginning and end of their service life. F-16s have already been in service over 25 years and will certainly be replaced by a new fighter aircraft during the ~~40-year~~ operation of the proposed PFS facility. Any estimate of future crash rates must therefore approximate the entire service life of the F-16 as the best predictor of the next ~~40~~ plus 20 years of aircraft crashes in Skull Valley.

Q. 34: Please explain the nature of the variance in crash rates over the service life of the F-16.

A. 34: Crash rates are higher when a fighter aircraft is initially put into service. During the middle of the aircraft's service life, the crash rates become lower. Near the end of an aircraft's life, the crash rates begin to rise again. This phenomena is known as the "bathtub" effect, and is particularly pronounced in the beginning years of an aircraft's service life. When I was stationed in Langley, Virginia, I became familiar with a number of Air Force studies which showed the bathtub effect. See State's Exhibit 52, graph showing the bathtub effect for the F-16.

F-16s have been flown for over 25 years and I expect that they will reach the end of their service life within ten years. See also, State's Exhibit 53, news article citing Jacques Gansler, Pentagon acquisition chief, stating that the F-16 will reach the end of its life span around 2009-2010. Based on my experience, I believe the crash rate for F-16s will trend up during its remaining years of service. It is commonly accepted by Air Force operations and maintenance personnel that crash rates begin to rise near the end of a fighter aircraft's life span. The rise in crash rates is due to fewer new replacement parts and the aircraft generally becoming more difficult to maintain as the fleet ages.

Q. 35: What aircraft do you believe will replace the F-16 at the end of its service life?

A. 35: It will likely be another single engine fighter and most probably the Joint

Strike Fighter ("JSF").¹ The United States Department of Defense has awarded a contract for System Development and Demonstration of the JSF. See State's Exhibit 54, Department of Defense ("DOD") October 26, 2001 News Release, *JSF Contractor Award*. DOD expects the first JSF flight to occur in "about four years." See State's Exhibit 55, Department of Defense ("DOD") October 26, 2001 News Transcript of live interview of Undersecretary of Defense, Edward Aldridge. It is reasonable to assume that the Air Force will initiate JSF training well within the planned life of the PFS facility and that the JSF will conduct training missions over Skull Valley.

Q. 36: What crash rate do you expect the replacement aircraft for the F-16 to experience?

A. 36: I expect that the JSF or other replacement fighter for the F-16 will experience high initial crash rates as have other fighter aircraft. Figure 2, located after page 9a of PFS's Crash Report, illustrates the high initial crash rates that various single engine fighters have experienced. It should be noted, however, that the Figure 2 chart seriously understates the high initial crash rates by not including the first 100,000 hours of flight, the period when crash rates are the highest. This distortion, in effect, eliminates the first seven years of F-16 crash experience. The entire service life of the F-16 is the best predictor of crash rates for the JSF's service life over the next ~~40~~ 20 years. The same would be true if another replacement fighter is chosen.

Q. 37: The PFS Crash Report and SAR use the average F-16 crash rate for the ten year period FY89 to FY98 to calculate the probability of aircraft impact hazards to the proposed PFS facility. Does that ten year period provide a basis for a realistic estimate of aircraft impacts to the PFS facility?

A. 37: No. As shown in Exh. 50, the F-16 crash rates during FY89 to FY98 are the lowest for any ten year period during the F-16's flight history of over 25 years. Selecting the lowest crash rate disregards the upward trend expected at the end of the F-16's service life and disregards the high crash rates expected during the early years of the F-16's replacement aircraft. Selecting the lowest ten year period does not approximate all phases of an aircraft's service life that will be encountered in the next ~~40~~ 20 years. Use of the ten-year FY89 to FY98 period is neither realistic nor conservative.

¹ PFS agrees that the JSF is the planned replacement for the F-16. Crash Report, Revised Addendum (July 20, 2001) at 11.

C. Lack of basis for assuming a pilot could maneuver a crashing F-16 aircraft to avoid impact to the proposed PFS site.

Q. 38: Do you have an opinion on PFS's assumption in its Aircraft Crash Report that an F-16 pilot can maneuver a crashing F-16 aircraft to avoid impact to the proposed PFS site?

A. 38: Yes, based on my experience as an F-16 pilot and F-16 instructor and from other factors, such an assumption of "able to avoid" is unrealistic and unconservative.

Q. 39: Are you familiar with F-16 emergency procedures, and if so describe those procedures for an in flight emergency such as engine failure.

A. 39: Yes, as a former F-16 pilot and F-16 instructor, I am intimately familiar with F-16 emergency procedures. Although I have never had to eject in an emergency, I have performed emergency procedures while flying both F-16s and F-111s because of engine, hydraulic, and electrical failure.

F-16 emergency procedures are as follows:

- (1) When a pilot experiences an in flight emergency, the pilot first determines whether control of the aircraft is retained. In some situations, such as an engine fire, the pilot may be forced to immediately eject even if control of the aircraft is retained.
- (2) If weather conditions permit, the pilot will then "zoom" the aircraft, i.e. climb by trading airspeed for altitude. Zooming the aircraft provides the pilot with additional time.
- (3) Then, without regard to location, the pilot will jettison all stores, such as weapons and fuel tanks. The pilot's main goal is to control the aircraft and buy time, not to consider where the weapons or fuel tanks will land.
- (4) Meanwhile, the pilot will communicate the emergency. Additionally, given adequate time prior to ejection, the pilot will then perform various other procedures, such as restarting the engine. If the pilot must eject, time permitting, the pilot will assess his/her ejection scenario (e.g., ensuring a minimum ejection altitude of 2,000 feet above ground level, ensuring ejection

does not occur into the mountain or lake, identifying a large flat landing area, etc.). If time allows after all these procedures are completed, the pilot can only then assess whether there are any populated or built-up areas to avoid.

- (5) The pilot must eject at a minimum altitude of 2,000 feet above ground level in a controlled situation. However, in an uncontrolled situation, the pilot must eject at 6,000 feet above ground level.

Q. 40: Are performing emergency procedures in an F-16 different from those in other multi-engine or multi-seat aircraft?

A. 40: Yes, performing emergency procedures in a single seat, single engine fighter jet, such as an F-16, is different and dramatically more demanding than in a multi-seat or multi-engine aircraft. In addition to losing all power when an engine malfunctions in a single engine fighter, there is no one to assist the pilot with emergency procedures. For example, during an emergency in bad weather, a single seat, single engine pilot must concentrate on flying the aircraft and has less time to implement emergency procedures or analyze and respond to the problem.

Q. 41: What are aircraft crashes and what are the causes of F-16 crashes?

A. 41: Military crashes are sometimes referred to as mishaps or accidents. A "Class A Mishap" is defined by the U.S. Air Force as an accident involving a fatality or the aircraft incurs more than \$1 million in damages. The leading cause of F-16 crashes is pilot error, which account for 52% of Class A mishaps, according to Lockheed Martin, the manufacturer of the F-16. Engine related mishaps account for 36% of Class A mishaps. This data can be found in Air Force Magazine, May 1999, Vol. 82, No. 5, a copy of which is included in pertinent part as State's Exhibit 56.

Crashes are also be caused by the pilot losing consciousness, mid-air collisions with other aircraft, bird strikes, weather conditions, and various types of mechanical failures.

Q. 42: What factors determine whether a pilot could maneuver a crashing F-16 or similar aircraft to avoid impacting the proposed PFS site ?

A. 42: Many factors influence whether an F-16 pilot could or would even attempt to maneuver a crashing fighter aircraft to avoid impacting the proposed PFS site. Those factors include whether the pilot remains conscious, whether the aircraft responds to pilot

control, whether the pilot forms an intention to take avoidance measures relative to the PFS facility, whether the pilot can locate the PFS facility due to weather or other conditions, whether there is time to take avoidance measures, the experience level of the pilot, and human factors which impair the pilot's decisions in emergency situations.

Q. 43: Explain G induced loss of consciousness and how it could prevent a pilot of a crashing F-16 from avoiding impact to the PFS facility.

A. 43: G induced loss of consciousness occurs when a pilot becomes unconscious because of the "G" or gravity forces imposed on the pilot. G induced loss of consciousness could occur while performing a hard turn. The Air Force defines a "hard turn" as an energy sustaining turn. This turn is typically done with military power, not afterburner. Depending upon airspeed and altitude, a hard turn could impose between 3.5 to 6 Gs on a pilot. When conducting a G awareness warmup turn, the pilot experiences approximately a 4 G force. A G awareness warmup is considered a "hard turn." Consequently, a pilot may lose consciousness when performing G awareness exercises conducted in Skull Valley. Additionally, I have observed that pilot's bodies react differently to G forces following a non-flying period. Obviously, a pilot who incurs a G induced loss of consciousness would not be able to take any action to avoid the PFS facility. The Air Force has determined that the cause of thirteen F-16 Class A mishaps were due to G induced loss of consciousness. See State's Exhibit 50, F-16 G induced loss of consciousness crash statistics.

Q. 44: Explain why a crashing F-16 may not respond to pilot control and how it could prevent the pilot from avoiding impact to the PFS facility.

A. 44: The aircraft may sustain impact damage or a mechanical failure of the control systems that would prevent the pilot from maneuvering the aircraft away from the PFS facility or elsewhere.

Q. 45: What factors determine whether the pilot of a crashing F-16 would make a conscious decision to take action to avoid the PFS facility.

A. 45: A pilot's first concern upon realizing the aircraft is about to crash is for the pilot's survival. Survival is dependant on ejecting from the aircraft, a dangerous procedure which can cause severe injury or death if not done appropriately. Altitude and air speed are critical factors which will be considered by the pilot in making a safe ejection. The pilot will also consider where he/she can survive a parachute landing and for that reason will steer away from mountains, forested areas and bodies of water in winter conditions.

A pilot is also trained to jettison all stores, (e.g., fuel tanks, ordnance) before ejecting to reduce the aerodynamic drag on the aircraft to aid in the pilot's control. This also prevents their detonation if they remain onboard and crash as a result of crashing with the aircraft. A pilot may have other high priority tasks, such as trying to restart a malfunctioning engine which could prevent the crash and the need to eject.

The pilot's focus on survival will limit or entirely prevent the pilot from evaluating where the aircraft will impact or trying to locate a specific site and maneuvering the crashing aircraft away from it. The only training an Air Force pilot receives with respect to avoiding ground sites, is contained in a flight manual which instructs a pilot to avoid populated or built-up areas. The PFS facility occupies an area of only 0.13 square miles and neither appears to be a populated area nor a built-up area with commercial or residential buildings. Therefore, a pilot may not even make a conscious decision to maneuver a crashing F-16 away from the PFS site.

Q. 46: Explain your basis for concluding that the pilot's focus on survival may prevent any effort to locate and steer the crashing aircraft away from a ground site such as the proposed PFS facility.

A. 46: I have discussed specific mishap circumstances with four active duty F-16 pilots who have ejected from aircraft. Three of the pilots ejected from F-16s and one pilot ejected from an F-111, a two engine fighter aircraft.² All four pilots said their thoughts were focused on their own survival and all of the pilots said they did not even consider where the aircraft would impact and did not consider where the jettisoned stores would impact. All four pilots stated that if they were required to eject in the future, given the same set of circumstances, they would again not consider where their aircraft or ordnance would impact.

²The four pilots are: 1) Major Tom Smith, whose January 13, 1995 F-16 crash is the subject of an accident report reviewed in the PFS Crash Report; 2) Captain Pietrykowski, currently assigned to the 388th Fighter Wing at Hill AFB, who ejected from an F-16 on June 21, 2000, near Cold Lake, Canada; his F-16 was flying at 1,700 feet AGL at 540 KIAS on a straight and level course when it encountered a bird strike; 3) Lt. Tidgewell, currently assigned to the 388th Fighter Wing at Hill AFB, who ejected from an F-16 on October 17, 2001, at Hill AFB; his F-16 was on the runway traveling at 150 KIAS when it encountered a tire separation; and 4) Colonel ~~Couter~~ Coots, currently assigned to the 388th Fighter Wing at Hill AFB, who ejected from an F-111 on September 16, 1982, in the United Kingdom; his F-111 was on a final approach flying at 150 feet AGL at 150 KIAS when it encountered hydraulic failure.

The experiences of these four pilots is consistent with experiences of pilots noted in State's Exhibit 57, ALSAFECOM 02-1996 sent out by the Air Force Chief of Safety in 1996. ALSAFECOM 02-1996 advised that 73% of ejections in the proceeding six months had occurred below the published minimum altitude of 2,000 feet AGL, and that futile attempts to restart failed engines were driving pilots to eject below the minimum altitude. A failed engine is a direct threat to the pilot's survival and causes the pilot to eject to save his life. Restarting the engine, like ejection, would also save the pilot's life, and without the dangers that accompany ejection. Attempts by pilots the restart to engine are directly related to a pilot's survival. Thus, the available information based on pilots who have actually ejected in emergency situations indicates that their attention during the emergency is riveted on their survival.

Q. 47: Describe Major Smith's emergency experience and how PFS has used it to predict a pilot's ability to avoid impact to the PFS site.

A. 47: During an orientation flight in an F-16D, Major Smith's engine caught fire and ceased operating due to a mechanical problem. Although he zoomed the aircraft to trade airspeed for altitude and time, Major Smith told me that he did not have time to think about where his jettisoned stores or aircraft would impact. Major Smith's aircraft crashed into a golf course and his stores struck a farmer's field. Major Smith was an experienced pilot with just less than 500 hours of F-16 flying time and 987.5 hours total flying time at the time of the accident.

Contrary to Major Smith's statements, PFS has classified Major Smith's accident as "able to avoid" and used it to support the conclusion that a pilot in an emergency situation would locate and avoid impact with the PFS site. See *Crash Report* at Tab H, Table 1.

Q. 48: Explain why a pilot of a crashing F-16 may not have time to maneuver the aircraft to avoid impact to the PFS facility prior to ejecting.

A. 48: U.S. Air Force procedures and training require the pilot to perform other emergency procedures prior to even considering whether to attempt to steer the aircraft away from a populated or built-up area. There is often only seconds or no time remaining after required emergency procedures and before ejection to assess and carry out measures that would avoid impact to the PFS facility site.

Q. 49: Explain how the experience level of a pilot of a crashing F-16 would

influence the pilot's ability to avoid the aircraft impacting the PFS facility.

A. 49: During an emergency situation an inexperienced pilot may take longer to perform tasks or not be capable of performing them at all. In particular, an inexperienced pilot would have more difficulty performing adequately in a low altitude flight emergency. For example, an inexperienced pilot is more likely to focus on a particular aspect of the emergency procedures, such as restarting an engine or ejecting, and may not be capable of identifying the proposed PFS site and steering the aircraft away. As a qualified flight instructor, I have flown with and evaluated the performance of a number of pilots who, because of their lack of experience, would not in my opinion have the situational awareness to select where they were going to eject and would be unable to take appropriate action to avoid a facility such as the proposed PFS facility.

Q. 50: Describe the range of experience of pilots likely to fly in Skull Valley.

A. 50: Similar to all fighter wings, the 388th and 419th Fighter Wings stationed at Hill Air Force Base are comprised of both experienced and inexperienced pilots and therefore both inexperienced and experienced pilots will be flying in Skull Valley. Depending upon actual flying time and experience in other fighter aircraft, a pilot is generally classified as "experienced" by the U.S. Air Force after flying F-16s for 3 years.

The ratio of experienced to inexperienced F-16 pilots is going down due the downsizing of the military over the last decade. In FY2000, approximately sixty percent of the 388th Fighter Wing pilots could be classified as experienced and forty percent as inexperienced. However, as of February 2002, only about forty-eight percent of 388th Fighter Wing pilots could be classified as experienced. Over the last two years the ratio of experience pilots to inexperienced pilots at the 388th Fighter Wing has dramatically dropped.

Q. 51: Explain how human factors would influence the ability of the pilot of a crashing F-16 to avoid the aircraft impacting the PFS facility.

A. 51: Pilots are under great physical and emotional stress during in-flight emergency situations, which causes their performance to deteriorate. They are more likely to take inappropriate actions under the stress of an emergency. Pilot error causes 52% of Class A F-16 accidents, according to F-16 manufacturer, Lockheed Martin.

Q. 52: Has the U.S. Air Force recognized that stress induced by in-flight emergencies causes pilots to perform poorly?

A. 52: Yes. The Air Force Chief of Safety sends out messages known as ALSAFECOMs to distribute critical safety information. During 1996, the Air Force Chief of Safety sent out ALSAFECOM 02-1996, one of only four ALSAFECOMs sent out that year. It advised that 73% of ejections in the proceeding six months had occurred below the published minimum altitude of 2,000 feet AGL. It also advised that incorrect assessment of airborne situations and timely ejections had become a problem. It also noted that erroneous assumptions and poor airmanship flourished in IFE situations. It concluded that "Human factors specialists indicate that crew members, when confronted with IFE induced stress, may need external or interpersonal intervention to alter their inappropriate performance/actions." See ALSAFECOM 02-1996, State's Exh. 57.

Q. 53: Explain why a pilot may not be able to locate the PFS facility due to weather conditions and how weather conditions could prevent the pilot from avoiding a crash into the PFS facility.

A. 53: Cloud cover in Skull Valley may prevent the pilot from seeing the PFS facility and therefore prevent the pilot from being able to steer away from the facility. A cloud ceiling is defined as 50 percent cloud cover and would obstruct the pilot's view of the PFS facility. A pilot cannot penetrate cloud cover without an instrument flight rules clearance provided by Clover Control. If cloud cover is "scattered," 25 percent of the sky is covered. In many cases a scattered cloud cover may obstruct a pilot's view of a structure such as the PFS facility.

If an F-16 flying below cloud cover experiences engine failure, the pilot would not zoom (trade speed for altitude) into the clouds, but would remain at the lower altitude and may be forced to eject immediately due to low altitude. In this situation, the pilot may not have time for any emergency procedures, including locating and steering the aircraft away from the proposed PFS facility. Additionally, if a pilot is flying in, or above, a cloud deck, then the pilot would not be able to visually locate the PFS facility.

Q. 54: In its Crash Report, PFS claims that pilots fly through Skull Valley only under visual flight rules, do you agree?

A. 54: No. While flying through Skull Valley, weather may require pilots to fly instrument flight rule. Instrument flight rule conditions in Skull Valley do not rule out training over the UTTR range. Visual flight rule conditions may not be present in Skull Valley yet the weather over the UTTR may be adequate to perform some or all of the

specific planned training mission. Additionally, some pilots may be forced to train in less than optimum weather due to their need for actual flight training hours and to retain their qualifications. For example, the 419th is an Air Force Reserve Fighter Wing. The 419th pilots only have the opportunity to fly approximately five days a month. Reserve pilots who must fly to stay qualified may not have the luxury to reschedule and do fly on cloudy days.

Q. 55: Would visual flight rule conditions ensure that cloud cover would not impair the ability of a pilot of a crashing F-16 to see and avoid the proposed PFS facility?

A. 55: No. A pilot may still not be able to see the proposed facility if flying under visual flight rules. In order to fly under visual flight rules in the Sevier B MOA, a pilot must have at least 5 miles of visibility in front of the aircraft. In addition, the aircraft must be clear of clouds, which means a distance of 1,000 feet above clouds and 500 feet below clouds. However, a pilot may fly under visual flight rules but fly either above or below clouds. I have flown many times above cloud cover through Skull Valley.

Thus, even if the weather is clear under visual flight rules, and a pilot is flying 1,000 feet beneath a cloud ceiling at 7,000 feet mean sea level (approximately 2,500 feet AGL), then the pilot would only have seconds before he/she had to eject at the minimum altitude of 2,000 feet AGL. The cloud ceiling would not allow the pilot to zoom the aircraft (trade speed for altitude) to gain additional time.

Q. 56: Do F-16 pilots flying in Skull Valley encounter cloud cover and if so, how frequently?

A. 56: Yes. Michael Army Airfield is located approximately 17.25 miles southwest from the proposed PFS facility. This is confirmed by the PFS Crash Report at page 56. Because of the close proximity, Michael Army Air Field weather data is representative of the weather in Skull Valley. *See also*, State's Exhibit 58, Deposition Transcript of Donald E. Fly (Dec. 12, 2000) at 85. Annual data from Michael Army Airfield show there is cloud cover (greater than 50 percent) 46 percent of the time at or below 12,000 feet above ground level. *See* State's Exhibit 59, International Station Meteorological Climate Summary, dated 12/9/00.

Q. 57: Is data obtained from the National Weather Service more accurate than the cloud ceiling data from Michael Army Airport?

A. 57: No. The National Weather Service data is not data certified by the Federal Aviation Administration ("FAA") or used by pilots. For example, in contrast to the FAA's definition of a cloud ceiling, the National Weather Service defines a cloud ceiling at 60 percent cloud cover. Exh. 39 at 43, n.33. The FAA defines a cloud ceiling as 50 percent cloud cover. Thus, cloud cover according to the National Weather Service is meaningless for pilots. For example, without instrument flight rules, a pilot could not penetrate clouds described as free of cloud cover by the National Weather Service if there is 50 percent cloud cover. Moreover, 60 percent cloud cover does not mean pilots could see the proposed PFS site.

Q. 58: Does UTTR have weather 96 percent of the time of at least a 3,000 foot ceiling and three miles of visibility and how would such weather affect the ability of a pilot to see and avoid the PFS facility in a crash situation?

A. 58: If 96 percent of the time the UTTR has weather of at least a 3,000 foot ceiling and three miles of visibility as suggested in Exh. 39 ¶ 104, that simply means that 96 percent of the time the cloud cover would be located at 3,000 feet or higher. A pilot flying above the cloud cover could not see the proposed site and therefore, could not avoid it. Essentially a ceiling of at least 3,000 feet 96 percent of the time only ensures that a pilot flying under 3,000 feet above ground level would not encounter cloud cover four percent of the time. However, if the pilot flew below 3,000 feet above ground level, then depending upon the actual ceiling altitude, the pilot may not be able to zoom the aircraft to gain additional time and may be forced to eject immediately. Pilots will not zoom the aircraft into clouds. It is unlikely that pilots flying below 3,000 feet AGL who are prevented from zooming due to cloud cover would have time to steer the aircraft away from the PFS facility before ejecting.

Q. 59: Will pilots always fly beneath the weather in Skull Valley?

A. 59: No. Pilots fly above the weather in many cases. If there were clouds in Skull Valley, I intentionally flew above the weather. If there is a solid cloud ceiling at say 9,000 feet mean sea level (approximately 4,500 feet AGL) and I was flying below the weather, at some point I would have to climb above the weather to continue my mission because just south of Skull Valley, Clover Control cannot see aircraft below 10,000 feet above ground level on its radar due to line of sight limitations. Thus, in order to penetrate the cloud deck (or fly through), the pilot must have clearance from the radar control agency, Clover Control. Because Clover Control could not locate the aircraft, it would be unable to provide the required clearance. Then I would be prohibited from climbing above the

weather without instrument flight rule clearance in the Sevier B MOA. Therefore, I would enter Skull Valley above 10,000 feet mean sea level with an instrument flight rule clearance. If a pilot flew below the cloud deck, Clover Control could not provide assistance to penetrate the cloud deck because it cannot identify low level aircraft flying in Skull Valley.

Q. 60: Is cloud cover the only weather factor that would affect the ability of a pilot to avoid to PFS facility in a crash situation?

A. 60: No. A pilot may not be able to see the PFS facility due to ground fog. Utah often experiences severe ground fog in the winter. Although flying conditions may otherwise be clear, a pilot may not be able to see the PFS facility because it is concealed by ground fog.

Q. 61: Are there factors other than weather that could prevent a pilot from locating the proposed PFS site?

A. 61: Yes. If accident circumstances do not require an immediate ejection, a pilot will lift the nose of the aircraft during an emergency procedure which limits the pilot's visibility. Depending on the degree to which the nose is lifted, the pilot's view of the ground could be blocked for the entire distance that the aircraft could glide.

Q. 62: In its Crash Report, PFS states that if the proposed PFS site is not visible, the pilot would use navigation instruments or radio to locate the site. Is that correct?

A. 62: No. Contrary to PFS's claims, a pilot cannot rely on his instruments to locate the PFS facility during an emergency. If the engine fails, the precision in the navigation system is reduced. The instruments work on and off for short periods of time as the electrical systems switch to backup systems; so a pilot cannot rely on them. In addition, a pilot would not call Clover Control to locate the proposed PFS facility when time is critical in an emergency. Moreover, during an emergency, Clover Control may be able to direct a pilot away from a large area such as Salt Lake City but would not be able to direct a pilot away from an area as small as the proposed PFS facility.

Q. 63: Could an F-16 pilot use the Stansbury or Cedar Mountains as reference points in steering the aircraft away from the PFS facility in an emergency even if a pilot could not see the facility?

A. 63: Using the Stansbury or Cedar Mountains as reference points is unlikely to provide assistance in avoiding the PFS facility. These mountains merely indicate Skull Valley and the PFS facility is located between them. The pilot's primary focus is to eject safely and if possible to save the aircraft. A pilot would not attempt to avoid the PFS facility by heading toward the mountains because they are not a safe place to eject. It is highly improbable that a pilot could determine the location of the 0.13 square mile PFS facility in Skull Valley by reference to surrounding mountain ranges. Even if an initial estimate could be made, its location relative to the aircraft will continually change, requiring the pilot to track the distance and direction the aircraft travels following the estimate, which requires the pilot to estimate the speed of the aircraft as it continues to decrease following loss of power or other emergency event. The pilot would have to accomplish this while under the stress of performing emergency procedures, without being able to rely on the accuracy of the navigation systems, and while contemplating imminent ejection. It is completely unreasonable to assume a pilot could rely on reference points such as the Stansbury and Cedar Mountains to locate and avoid the PFS facility. Further, if the PFS facility is not visible due to clouds, the pilot may not be able to see the mountains for the same reason.

Q. 64: Does the Air Force keep statistics showing the success rate of pilots of crashing F-16s or other fighters in identifying a specific ground site and maneuvering the aircraft to avoid impact with it?

A. 64: No. I am not aware of any statistics kept or studies that have been done by any military or other organization which address the success rate of pilots in identifying or avoiding specific ground sites in a crash situation. Further, I am not aware of any data available on which to base such a study. The accident reports kept by the Air Force, such as those reviewed by PFS, rarely mention whether the pilot attempted any avoidance maneuver. In the few instances that mention the pilot taking general action such as pointing the aircraft away from a populated area, there is no further detail given. It would be unknown if the pilot took action based on the general awareness of a large location such as a city or bailout area, or whether the pilot visually located one or more specific sites of smaller size and successfully chose and avoided a specific small site like the PFS site.

Q. 65: Are you aware of any published authorities or articles in military or industry journals that suggest that the success rate of F-16 pilots in avoiding aircraft crash impacts to a specific site can be predicted or quantified?

A. 65: No. I am not aware of any published work or authority that has attempted to quantify or predict the probability that a pilot in a crash situation would successfully avoid impact with a specific ground site. To my knowledge, no methodology to calculate such a

probability has ever been used, subjected to peer review, or even proposed by any authority or in any published work.

Q. 66: When does the Air Force issue accident reports and what is their purpose?

A. 66: The Air Force is required to investigate all class A mishaps and accidents with high public interest, and to issue a report of the investigation in accordance with AF Instruction 51-503, State's Exhibit 60. AF Instruction 51-503 sets forth the required method of conducting an accident investigation and the information that the accident report must contain. The purpose of accident investigations is to provide a publicly releasable report of the facts and circumstances surrounding the accident including a statement of opinion on the cause of the accident, and to preserve evidence for claims or litigation.

Q. 67: What experience do you have with conducting an accident report for the Air Force?

A. 67: I served as the interim president of a Safety Investigation Board convened to investigate an F-16 crash.

Q. 68: Does AF Instruction 51-503 require accident investigators to establish the extent of populated or built-up areas existing in the vicinity of the crash?

A. 68: No. Identifying populated or built up areas in the vicinity of the crash is not mentioned in AF Instruction 51-503. I am not aware of any Air Force accident report that purports to identify all significant populated areas or other ground sites in the crash vicinity.

Q. 69: Does AF Instruction 51-503 require an investigation into what actions, if any, the pilot took to avoid crashing into populated or built up areas?

A. 69: No. AF Instruction 51-503 does not make any reference to investigating what actions, if any, were taken by the pilot to avoid populated or other ground sites.

Q. 70: Does AF Instruction 51-503 require an opinion or other statement as to whether the action or inaction of the pilot with respect to avoiding impact with a ground site was done properly or successfully?

A. 70: No. AF Instruction 51-503 does not require the accident report to include an opinion or other statement as to whether the pilot acted properly in any action or inaction

with respect to avoiding impact with a ground site. Furthermore, I have never seen an accident report that included such an opinion or statement. Neither does AF 51-503 require the accident report to include an opinion or statement as to whether a pilot's efforts, if any, were successful in avoiding impact with a particular ground site.

Q. 71: Do the Air Force accident reports reviewed by PFS provide a basis to predict whether pilots of crashing F-16s would successfully avoid an impact to the PFS facility?

A. 71: No. In its Crash Report, PFS classified various accident reports from FY 1989 through 1998 as "able to avoid" based on PFS's estimate that the pilot had control of the aircraft and time to steer the aircraft away from a facility, such as the PFS facility, before ejecting. PFS then concluded that the percentage of "able to avoid" accidents was also the probability that a pilot would in fact take successful actions to locate and avoid impact to the PFS site.

However, the accidents classified as "able to avoid" by PFS are not accidents where the pilot identified a site similar to the proposed PFS facility and successfully maneuvered the aircraft to avoid impact with it before ejecting. In fact, none of the 126 reports over the 10 year period reviewed by PFS discloses a situation where a pilot located a specific ground feature, such as the PFS facility, and took action to avoid impacting it. Only a few reports even mention an effort by the pilot to point the aircraft in a general direction, such as away from populated areas. Therefore, the reports identified by PFS as "able to void" are neither evidence that pilots have in the past located and avoided a specific ground site, nor do they offer a basis to predict that pilots would in the future, locate and avoid the PFS facility.

IV. POTENTIAL FOR ORDNANCE TO IMPACT THE PFS FACILITY.

Q. 72: Do F-16s carry ordnance while flying through Skull Valley?

A. 72: Yes. F-16s transiting Skull Valley may carry between zero and six ordnance per flight. An F-16 may carry two MK-84s (2,000 lb. bombs) per flight. *See also* State's Exhibit 61, Memorandum from Colonel Ronald G. Oholendt, U.S. Air Force (October 26, 1999)³.

³ Note: Colonel Oholendt provides the number of ordnance "normally" carried on a 388th Fighter Wing aircraft during FY98. However, the number of ordnance identified does not bound the number of ordnance per aircraft.

Q. 73: In the event of an F-16 emergency, what happens to the ordnance?

A. 73: After a pilot zooms the aircraft, the pilot will release the bombs and fuel tanks from the aircraft, known as "jettison all stores." A pilot typically will take no action to select where the ordnance will impact. This is because immediate jettison of all stores may be necessary to retain control of the aircraft, and also because the pilot's attention in an emergency will be focused on tasks relating to the pilot's survival, such as restarting a failed engine and safely ejecting.

Q. 74: Could jettisoned ordnance strike and penetrate the proposed PFS storage casks?

A. 74: Yes. Live and inert ordnance may potentially strike and penetrate the proposed PFS storage casks and canisters. Using PC effects model⁴, the U.S. Air Force determined that the GBU-24 A/B and the GBU-10 with the BLU-109 warhead could penetrate the proposed PFS storage cask and canister (HI-STORM 100). Attached is State's Exhibit 62, USAF letter from Colonel Lee C. Bauer; and State's Exhibit 63, USAF letter from Denise L. King. The Air Force also estimated the maximum probability that the MK-84 warhead configured as a GBU-10, GBU-24, or free-fall unguided ordnance would penetrate the cask and canister to be 0 to 50 percent. See King letter, Exh. 63. The Air Force estimate did not consider the possibility that the cask or canister may buckle or crack. Also, the Air Force assumed only inert weapons in its estimates and did not account for any potential weakening of steel due to an explosion.

Q. 75: Describe the ordnance path after jettison.

A. 75: Once a pilot jettisons the ordnance, the bombs will fly in a predetermined parabola and impact the earth according to that parabola. The parameters for the parabola are speed at jettison, altitude at jettison, pitch of aircraft at jettison with respect to the horizon, and aerodynamic drag of the bombs.

Q. 76: How does the 388th Fighter Wing determine how many aircraft will carry ordnance and what type?

A. 76: That decision is based on the current tactics of the Air Force and budget. The actual number of ordnance used each year could vary dramatically.

⁴ Joint Munitions Effective Manual Air to Surface Weaponing Systems. See Oholendt letter, Exh. 61.

Q. 77: Explain whether or not PFS has used a realistic number of ordnance carried annually in calculating the probability of ordnance impact to the proposed PFS facility?

A. 77: As shown in the July 20, 2001 Revised Addendum its Crash Report, p.30 and the May 31, 2001 Response to RAI at p.12-16, PFS has reduced the probability it had previously calculated for impact from ordnance, by using FY00 data rather than the higher FY98 data. However, the more recent FY00 data is an anomaly and not indicative of usual training. On February 1, 2001 I was advised by 388th Fighter Wing Operations Group Commander Colonel Couter, that the 388th Fighter Wing's training tactics changed in FY00 due to real world deployments. Squadrons from the 388th were deployed to the Caribbean to aid in the interdiction of drug smuggling aircraft. Hence, the 388th's training concentrated not on ordnance carrying missions such as bombing runs but on low level, low speed training. However, because of the current Air Force needs in Kosovo and Afghanistan, the 388th's current training tactics require more sorties to carry ordnance than in FY00. PFS's reliance on a fiscal year where ordnance training is an anomaly is not realistic to estimate the risks from ordnance carried by F-16s through Skull Valley over the next ~~40~~ plus 20 years. No reason has been offered by PFS as to why the FY98 annual ordnance data will not be repeated in the future, and therefore no less than FY98 data should be used, increased by the increase in sorties since FY98.

V. AIRCRAFT USING THE MOSER RECOVERY ROUTE.

Q. 78: Does PFS use realistic values in calculating the impact probability to the PFS facility site from aircraft on the Moser Recovery Route?

A. 78: No. In addition to incorrectly assuming that pilots will in fact avoid the PFS facility site in an emergency, PFS has used neither a realistic crash rate nor realistic annual sortie data, as I have mentioned elsewhere in this testimony. Also, PFS has incorrectly assumed that only 5% of flights returning from the UTTR South Area would use the Moser Recovery Route ("MRR").

PFS states that undisclosed "air traffic controllers" provided the 5% estimate, which was used by PFS in its August 13, 1999 submission.⁵ The use of the MRR has increased since the estimate relied on by PFS.

⁵Crash Report, p.49, n.57A.

The Moser Recovery Route is flown during inclement weather conditions or during night training missions. The Moser Recovery Route has been used more frequently since 1999 because the 388th Fighter Wing and the 419th Fighter Wing fly night vision goggle ("NVG") training missions. These missions were in the initial stages of being implemented during the latter part of 1999. The 5% estimate relied on by PFS was made before NVG training was implemented for all pilots. In calendar year 1999, when I was stationed at Hill AFB, I flew at least four night missions in seven months.

The Memorandum dated July 18, 2001 from Air Force Headquarters, shown in State's Exhibit 64, states that NVG training will increase and that of the total sorties flown in MOAs, "approximately one third will be night sorties." A realistic number of flights using the MRR could be as high as 33% of the sorties returning from the UTTR South Area.

VI. THE PFS ANALYSIS OF F-16 ACCIDENT REPORTS.

Q. 79: Is the PFS analysis of F-16 accident reports found at Tab H of the Crash Report useful in determining the risk of impact to the proposed PFS facility from aircraft?

A. 79: No. The stated objective of the analysis is limited to determining the percentage of flights where the pilot "would remain in control of the aircraft and have time to avoid the PFSF." Therefore, the analysis is designed only to identify accidents where the F-16 remained flyable and the pilot had some increment of time before ejecting. Even if the analysis correctly identified those accidents with an increment of time available to the pilot, that time would most likely be used on tasks related to the pilot's survival, not on attempting to locate and avoid the PFS facility site. Therefore, the fact that a pilot may have had some available time before ejecting is not useful in determining the risk of impact to the PFS facility, and classifying such accidents as "able to avoid" is not an accurate characterization and is, in fact, misleading.

Q. 80: Does the PFS analysis at tab H of the Crash Report correctly determine the probability of crashes in Skull Valley where the pilot "would remain in control of the aircraft and have time to avoid the PFS facility"?

A. 80: No. There are several reasons why the analysis does not correctly determine the probability of crashes in Skull Valley where the pilot would remain in control of the aircraft and have time to avoid the PFS facility.

PFS has only evaluated accident reports over a ten year period, not for the entire

accident history of the F-16. Additionally, PFS has not obtained and reviewed accident reports for 18 of the 139 (13%) F-16s that were destroyed in this period.

Of the accident reports that were reviewed, many were excluded from consideration by incorrectly assessing the flight phase, incorrectly concluding that the accident could not happen in Skull Valley, and incorrectly concluding that the accident occurred under conditions that are not similar to those experienced in Skull Valley within the Sevier B MOA. Additionally, excluding accidents on the basis that they do not match Sevier B MOA conditions improperly excludes those accidents that happen under conditions experienced in other air above the Sevier B MOA which is also used to transit Skull Valley.

Q. 81: Explain how PFS excluded F-16 accident reports by incorrectly assessing the phase of flight.

A. 81: Many times, PFS discounted an accident report because it classified the accident as special flight or take off or landing when in fact the aircraft was performing essentially normal flight at the time of the accident. I discussed these incorrect classifications in my declaration dated January 30, 2001, State's Exhibit 65. For example, PFS incorrectly classified a July 31, 1992 accident report as "takeoff" when the aircraft was at an altitude of 5,719 feet above ground when it was struck by lightning. After the accident aircraft performed takeoff, three additional F-16s also performed takeoff and were above 4,500 feet AGL at the time of the accident. The accident aircraft was essentially in normal flight when the accident occurred.

Q. 82: Explain how PFS excluded F-16 accident reports by incorrectly assessing Skull Valley Type Events and Sevier B MOA Conditions.

A. 82: PFS incorrectly excluded accidents that occurred at altitudes higher than 5,000 feet AGL and accidents while under instrument flight rules, both of which commonly occur in the Skull Valley. PFS also incorrectly excluded accidents caused by midair collisions, G induced loss of consciousness, bird strikes, lightning strikes, and poor visibility due to cloud cover, all of which could occur in Skull Valley.

Q. 83: Explain why midair collisions could occur in Skull Valley.

A. 83: During a September 16, 1997, F-16 accident, there was a midair collision when the back element (2nd) pilot in the formation lost situational awareness and hit the lead element aircraft. This accident occurred after take off and while the pilots were preparing for their night goggle training mission at 13,760 feet above ground level. Although one

aircraft successfully landed, the other aircraft was out of control and would have not been capable of avoiding the PFS facility or other site. Pilots conduct night vision goggle training in Skull Valley and a midair collision similar to this accident could occur in Skull Valley.

Q. 84: Explain why G induced loss of consciousness could occur in Skull Valley.

A. 84: Pilots may conduct G awareness turns in Skull Valley, which apply 3 to 4 G on a pilot. If a pilot has not flown for a period of time due to leave, injury, or another assignment, a pilot may not be physically capable of sustaining a G awareness turn and could lose consciousness. I have personally experienced this lack of ability to sustain G forces after a period of not flying, and it is a common experience among pilots.

Such an accident is described in the May 25, 1990 accident reviewed by PFS, where a pilot suffered G induced loss of consciousness on his first flight following return from leave. The accident occurred at 6,000 feet above ground level when the pilot turned to enter a low-level training route. During the descent to enter the low-level route, the mishap pilot suffered G induced loss of consciousness and crashed into the ground. This pilot was well qualified and experienced, but had just returned from a period of non-flying. The circumstances of this accident could occur in Skull Valley. G induced loss of consciousness accidents were improperly excluded by PFS.

Q. 85: Explain why bird strikes could occur in Skull Valley.

A. 85: The Air Force's report of the July 6, 1998 aircraft accident reviewed by PFS states that the accident was caused by birds impacting the aircraft. The report shows that the F-16 canopy is designed to withstand a bird strike of 4 pounds at 350 knots. See State's Exhibit 66, excerpt from AFI 51-503 Aircraft Accident Investigation Report. Pilots typically fly 400 to 450 knots through Skull Valley. While flying F-16s through Skull Valley I have frequently encountered birds that I estimate to exceed 4 pounds in weight.

According to the Handbook of North American Birds, State's Exhibit 67, American White Pelicans, Canada Geese, Great Blue Herons, Bald Eagles, and Golden Eagles all have weights ranging from 5 to 30 pounds and can fly at altitudes exceeding 1,000 feet above ground. These species have been identified at the Timpie Springs Waterfowl Management Area, located north of Skull Valley near the shoreline of the Great Salt Lake. The documentation of these species known to frequent the area is shown in the letter and attached surveys from the director of the Utah Division of Wildlife Services, shown in State's Exhibit 68. The presence of these species in Skull Valley can be expected as they fly

to or from wetlands including Timpie Springs and the Great Salt Lake.

Q. 86: Explain why PFS incorrectly excluded from its analysis F-16 accidents caused by lightning strikes.

A. 86: Although pilots will generally not fly in known and predicted lightning storms, lightning is not always predictable. It is reasonably foreseeable that a pilot will at some time fly in the presence of lightning as verified by the reports of accidents caused by lightning. I have personally flown in lightning and it cannot be disregarded as a hazard in Skull Valley.

1 provided with the changes for replacement changes
2 but not the entire replacement testimony. What has
3 been changed was the title page, Page 13, Page 14,
4 and Page 29. And what the parties were not
5 provided yesterday were the changes that Mr. Soper
6 talked about to Colonel Horstman's testimony with
7 respect to the four pilots and Major Smith ejecting
8 from their aircraft, which is on Page 18, answer to
9 Question 46. And the changes are underlined on
10 Page 18. Actually, I believe all the changes are
11 struck out and all the changes are shown.

12 JUDGE FARRAR: Okay. So you have
13 stricken not by hand but by typewriter, computer?

14 MS. NAKAHARA: Yes.

15 JUDGE FARRAR: What you are taking out
16 and you have underlined the new material?

17 MS. NAKAHARA: Yes. That's correct.

18 JUDGE FARRAR: Okay. Thank you.
19 Colonel Horstman, would you stand and be sworn,
20 please. Raise your right hand.

21
22 HUGH HORSTMAN,
23 called as a witness for and on behalf of the
24 State, being first duly sworn, was examined and
25 testified as follows:

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DIRECT EXAMINATION

BY MS. NAKAHARA:

Q. Colonel Horstman, the testimony that you have before you with the noted changes, do these reflect the testimony that you would like to offer?

A. Yes.

Q. And this is my preference, and not Counsel's, but I would like to explain the change on Page 18. In all fairness, it is my fault. Colonel Horstman reviewed his prefiled testimony extensively, with the exception of this paragraph, and we did this by cell phone on the date of filing while he was trying to run his venue for the Olympics, which is why I got Colonel Coots's name wrong, because Cooter is his call sign and Colonel Horstman refers to him as "Cooter" at times. And I didn't completely understand what he wanted written in the testimony.

COL. HORSTMAN: Your Honor, if I may. Without the underlined portion, that statement did a great disservice to all professional aviators.

JUDGE FARRAR: I'm astounded that in the flurry of papers that we have referred to in the last two months, that this is the only thing of this nature that has happened. And Ms. Nakahara,

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1 we appreciate your explanation and your obvious
2 concern about it. And given the way you have
3 presented it, we certainly appreciate your candor.
4 And let's move on as though nothing had happened.
5 And if counsel wants to pursue the matter, opposing
6 counsel wants to pursue it, they are welcome to.
7 But Ms. Nakahara is, as far as we are concerned at
8 this point, everything is fine.

9 MS. NAKAHARA: I would like to also
10 offer -- and in conjunction with Colonel Horstman's
11 testimony I'd like to offer State's Exhibit Number
12 38, which has been pre marked. It's Colonel
13 Horstman's resume.

14 State's Exhibit 39, which is our
15 references to the declaration of James L. Cole,
16 Jr., Wendell Jefferson, Jr., and Ronald E. Fly that
17 was submitted in conjunction with the Applicant's
18 Motion for Summary Disposition, dated December 30,
19 2000.

20 State's Exhibit 40, which is a partial
21 map of the Utah Test and Training Range and the
22 Sevier B MOA.

23 State's Exhibit 41, which is portions of
24 a web site from the Utah Test and Training web
25 site.

1 State's Exhibit 42, which is a
2 memorandum for Air Force representative with
3 respect to usage of Sevier B military operating
4 area.

5 State's Exhibit 43, which is portions of
6 a low altitude flight map.

7 State's Exhibit 44, which is a
8 memorandum to Air Force representative with respect
9 to military usage of Sevier D MOA.

10 State's Exhibit 45, which is a
11 memorandum for Air Force representative with
12 respect to the usage of restricted area 6402A; also
13 to a separate memo with respect to usage of
14 restricted area 6402-B; and a separate memo with
15 respect to restricted area R 6406.

16 State's Exhibit 47, which is a figure
17 out of PFS's aircraft crash report, Figure 1.

18 JUDGE FARRAR: You skipped 46.
19 Deliberately?

20 MS. NAKAHARA: I'm sorry. I believe 46
21 is one we withdrew pursuant to your order.

22 JUDGE FARRAR: Okay. Right. Okay.

23 MS. NAKAHARA: State's Exhibit 47 was
24 Figure 1 from PFS's aircraft crash report.

25 State's Exhibit 48 is a State

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1 modification of PFS's Figure 1 from the aircraft
2 crash report showing formations flying in Skull
3 Valley. Depicting formations flying in Skull
4 Valley.

5 State's Exhibit 49 is a portion of an
6 article with respect to the new F-16s that were
7 stationed at Hill Air Force Base.

8 State's Exhibit 50 is F-16 crash reports
9 published by the Air Force.

10 State's Exhibit 51 is selected pages
11 from publication UCRL-ID 124837 entitled "Data
12 Development Technical Support Document for the
13 Aircraft Crash Risk Analysis Methodology Standard".

14 State's Exhibit 52 is a chart showing
15 F-16 crash history.

16 State's Exhibit 53 is an article
17 entitled, "Joint strike fighter program must stay
18 on schedule," dated June 24, 2000.

19 State's Exhibit 54 is an e-mail release
20 concerning the JSF, the Joint Strike Fighter
21 contract award.

22 State's Exhibit 55 is an e-mail news
23 release from the Department of Defense concerning
24 the Undersecretary Aldrich interview with CNN
25 Moneyline, which also relates to the Joint Strike

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1 Fighter.

2 State's Exhibit 56 is a publication from
3 the Air Force Association dated February 4, 2002.

4 State's Exhibit 57 --

5 MR. GAUKLER: Could you say that again,
6 please?

7 MS. NAKAHARA: Air Force Association
8 publication dated February 4, 2002, which is
9 probably the date that it was printed on the web
10 site.

11 MR. GAUKLER: I think the article itself
12 shows a different date.

13 MS. NAKAHARA: I'm sorry. Thank you.

14 JUDGE FARRAR: Just for identification
15 now -- well, go ahead.

16 MR. BARNETT: It looks like May of 1999.

17 JUDGE FARRAR: Okay.

18 MS. NAKAHARA: Thank you.

19 State's Exhibit 57 which is an ALSAFECOM
20 dated March '96.

21 State's Exhibit 59, which is the
22 International Station Meteorological Climate
23 summary.

24 State's Exhibit 60, which is Air Force
25 instruction 51-503 dated April 5, 2000.

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1 State's Exhibit 61, which is a
2 Department of Air Force memorandum dated October
3 26, 1999 which is a reply to a FOIA request by
4 James Cole.

5 State's Exhibit 62, which is a letter
6 from the Department of Air Force to me, Connie
7 Nakahara, dated December 28th, 2000.

8 State's Exhibit 63, which is a letter
9 from the Department of Air Force, also to me,
10 Connie Nakahara, dated January 18, 2001.

11 State's Exhibit 64 is an Air Force
12 memorandum dated July 18, 2001 concerning Title 14
13 Code of Federal Regulations part 91.209 exemptions
14 requests which relates to night vision goggle
15 training.

16 State's Exhibit 66 is portions of an Air
17 Force accident report AFI 51-503, Aircraft Accident
18 Investigation Board report. The date of the
19 accident is July 6, 1998.

20 State's Exhibit 67 is portions from the
21 Handbook of Northern American Birds, Volume 1,
22 publication date of 1962.

23 State's Exhibit 68, which is a letter
24 from the State of Utah Department of Natural
25 Resources to Laura Lockhart dated January 26, 2001,

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1 with attachments which is a water bird survey.
2 Data from a water bird survey.

3 State's Exhibit 69 is an internet
4 article entitled First No-notice AEF Deployment
5 Underway, released July 8, 1997.

6 I would like to offer Colonel Horstman's
7 testimony and the exhibits I identified as read
8 into the record.

9 JUDGE FARRAR: Your last exhibit was
10 number --

11 MS. NAKAHARA: 69.

12 JUDGE FARRAR: The deployment. Every
13 one of these has on the front of it, at least on
14 our copy, a little notation of what exhibit number
15 it is.

16 MS. NAKAHARA: Yes.

17 JUDGE FARRAR: And we will consider them
18 at this moment as though they have been marked for
19 identification.

20 (STATE'S EXHIBITS-38-69 WERE MARKED.)

21 Q. And now you are moving for their
22 admission?

23 MS. NAKAHARA: Yes.

24 MR. GAUKLER: Your Honor, the only
25 questions I have are with respect to Exhibit

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1 Numbers 67 and 68 as to whether or not they would
2 be in Lt. Colonel Horstman's area of expertise in
3 that they concern water bird surveys, et cetera.

4 MS. NAKAHARA: Your Honor, Colonel
5 Horstman has, in his testimony, he states that he
6 has identified -- he has seen birds while flying
7 through Skull Valley but he cannot identify what
8 type of birds. And so he has selected references
9 that show the type of birds that are in the area.

10 JUDGE FARRAR: Why don't we defer
11 admission of those pending cross-examination, and
12 if necessary redirect. And we will see or test
13 your theory, Mr. Gaukler. Mr. Turk?

14 MR. TURK: Ms. Marco will speak for the
15 Staff, your Honor.

16 JUDGE FARRAR: Okay.

17 MS. MARCO: I don't have any objection.

18 JUDGE FARRAR: All right. The first one
19 of those was Number 38?

20 MS. NAKAHARA: Yes. That's correct.

21 JUDGE FARRAR: All right. Then we will
22 have admitted Exhibits 38, 39, 40, 41, 42, 43, 44,
23 45, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 59,
24 60, 61, 62, 63, 64, 66, and 69. That list did not
25 include 46, 58, and 65, which you did not ask to be

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1 identified. And it does not include 67 and 68
2 where we are holding action on your motion. The
3 others will be admitted at this point.

4 (STATE'S EXHIBITS 38-45, 47-64, 66,
5 and 69 WERE ADMITTED.)

6 MR. SOPER: Wasn't it 68 and 69 that you
7 moved on?

8 MR. GAUKLER: I'll look at that real
9 quick. It was 67 and 68.

10 MR. SOPER: I apologize.

11 JUDGE FARRAR: I think we got it right.
12 Ms. Nakahara, are you ready to tender?

13 MS. NAKAHARA: I would like to provide
14 these to the court reporter. And the person that
15 tries to organize me, which is very difficult, has
16 a list of exhibits which would have been helpful
17 when I was offering them.

18 JUDGE FARRAR: I think we had all
19 received that list at some point with your
20 prefiled.

21 MS. NAKAHARA: This is a revision.

22 MR. KLINE: I would like one.

23 JUDGE FARRAR: Now, is this just a
24 courtesy copy?

25 MS. NAKAHARA: Yes.

1 JUDGE FARRAR: Thank you, that is
2 helpful. And you have crossed out the three that
3 you did not offer, so that's already done. Thank
4 you. Did you have any brief questions of the
5 witness before you tender him?

6 MR. SOPER: No, your Honor.

7 JUDGE FARRAR: And does the reporter
8 have three sets? Okay. Then Mr. Gaukler, I guess
9 it's your witness.

10

11 CROSS EXAMINATION

12 BY MR. GAUKLER:

13 Q. Thank you. Good evening Lt. Colonel
14 Horstman. Late in the day to start. I apologize
15 for that.

16 A. It's all right.

17 Q. Call you Lt. Colonel? Is that all
18 right?

19 A. That's fine.

20 Q. Lt. Colonel Horstman, obviously Generals
21 Cole, Jefferson and Col. Fly are very appreciative
22 that you corrected your testimony because that was
23 very upsetting to them, as professional Air Force
24 pilots. And we appreciate that.

25 I would like to hand out your

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1 declaration, and I'm not going to mark this as an
2 exhibit, that you filed in support of the State of
3 Utah's Response to PFS's Motions in support of the
4 State's Opposition for Summary Disposition. Do you
5 remember that?

6 A. I believe so. Let me review it.

7 I'm familiar with it.

8 Q. Is it correct to say, Lt. Colonel
9 Horstman, if you turn to Paragraph 60 of that
10 declaration, that would correctly state your
11 position in terms of a pilot's ability to avoid a
12 site on the ground? If you could read that for me,
13 please.

14 A. Out loud?

15 Q. Yes.

16 A. Yes. "Most importantly, whether a pilot
17 can control an aircraft and guide it away from a
18 built-up area is dependent on adequate time and
19 circumstances. See also aircraft hazard report at
20 17. I agree that any pilot, given adequate time
21 and circumstances, would steer his or her aircraft
22 away from a built-up or population area. However,
23 in order to steer his or her aircraft away from the
24 proposed PFS facility, pilot must have adequate
25 time and be able to see the proposed facility."

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1 Q. Thank you. You've heard the General
2 Cole and General Jefferson and Col. Fly testify in
3 terms of the type, the typical type of accident one
4 might expect in Skull Valley, an F-16 transiting
5 Skull Valley, a typical failure might be one
6 involving engine failure?

7 A. I heard their testimony.

8 Q. And you would agree with that; that is a
9 typical type of failure that could occur?

10 A. Not necessarily, no.

11 Q. That would be one type of failure that
12 could occur?

13 A. Yes.

14 Q. And you heard the testimony of Col. Fly
15 in terms of what a pilot would do, assuming that he
16 had control of this plane. In an engine failure he
17 would zoom up to gain altitude and trade speed for
18 altitude to give him more time to attempt to
19 restart the engine; correct?

20 A. Correct.

21 Q. And just take that type of example. In
22 that type of example you would expect that a pilot
23 generally would have the time and opportunity, he
24 would be in control of the plane; correct?

25 A. I do not assume that. I assume that he

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1 has the time.

2 Q. You assume he has the time.

3 A. Yes.

4 Q. Okay. Well, assume that -- well, let's
5 assume the pilot is in control of the plane.

6 A. Okay.

7 Q. And assume there's no cloud cover.

8 A. Okay.

9 Q. And he zooms up, trades speed for
10 altitude. In that type of circumstance, he would
11 have the time and opportunity to avoid the site.

12 A. Yes.

13 Q. And this is even true if he was flying
14 as low as 1000 feet AGL?

15 A. He would have the time. Assuming that
16 the weather and that he is in control, he would
17 have the same or a similar opportunity.

18 Q. Okay. In fact, we talked about that in
19 your deposition back in December of 2000.

20 A. Yes.

21 Q. December, 2001. Excuse me. 2000. Time
22 flies. And you agreed that a pilot would, in those
23 circumstances, have the time and opportunity?

24 A. Yes.

25 Q. And basically you also said that a

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1 pilot, in those type of circumstances, would make
2 an attempt to avoid the facility.

3 A. Yes. I'm in complete agreement that,
4 given the right set of circumstances, the pilot
5 would intentionally avoid the PFS site.

6 Q. Now, you look at Question and Answer 45
7 in your prefiled testimony where you talk about
8 what factors determine whether the pilot of a
9 crashing F-16 would make a conscious decision to
10 take action to avoid the PFS facility. The second
11 sentence there, you refer to, you say, "Survival is
12 dependent on ejecting from the aircraft, a
13 dangerous procedure which can cause severe injury
14 or death if not done appropriately." Would the
15 potential hazard from an ejection depend upon
16 whether the ejection was taken from an aircraft in
17 which the pilot had control of the aircraft as
18 opposed to one that was uncontrollable?

19 A. It depends. And let me expand. This
20 morning we saw an individual who had perfectly good
21 control of the airplane; actually, two individuals
22 who had control of an aircraft. And they both
23 ejected below 200 feet. One of them ejected so low
24 that he broke his back, which is a serious injury.
25 Obviously air speed, the higher the air speed the

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1 more potential for danger. So if you are out of
2 control, you may not have the ability to slow the
3 aircraft down, maybe point it downhill. But you
4 can't correlate, necessarily, an out-of-control
5 aircraft with a safe or unsafe ejection.

6 Q. Is it true that if you are -- ejection
7 procedures for the F-16 that we talked about with
8 Col. Fly, says that the first -- you should try to
9 slow down the airplane as much as possible before
10 ejecting, which would presuppose you would be in
11 control of the aircraft to do so?

12 A. If you are out of control, you can't do
13 that.

14 Q. And if you are in control you can do
15 that?

16 A. If you are below 2000 feet, no, you
17 could not.

18 Q. If you are above --

19 A. You are going to have to rephrase the
20 question. I don't understand it.

21 Q. Okay. Now, the -1 refers to the fact
22 that pilots should try to slow down the plane as
23 much as possible before ejecting; correct?

24 A. Yes.

25 Q. And we heard much discussion with

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1 respect to potential flailing injuries, et cetera.
2 Assume that a pilot slows down a plane in the range
3 of 225 knots, which Col. Fly said that would be
4 about the range you would try to get your plane at
5 before ejecting; assuming you had the time and are
6 able to zoom, et cetera. You would not have those
7 type of injuries per what the -1 says; correct?

8 A. I don't believe you characterized
9 Colonel Fly's testimony correctly. I believe that
10 what he said was that you would glide at that speed
11 and upon reaching 2000 feet you would slow down to
12 an even slower speed.

13 Q. Okay. And isn't it correct that the -1
14 says that -- let me show you a copy.

15 May I approach, your Honor?

16 This is PFS Exhibit PPP.

17 A. I'm familiar with it.

18 Q. Okay. That refers -- the second-to-the-
19 last bullet you see on the Ejection, under Ejection
20 on that page, refers to flailing. "Wind blasts
21 exert medium force on the body up to 450 knots and
22 severe forces causing flailing and skin injuries
23 between 450 and 600 knots, and excessive force
24 above 600 knots." You have a reason to take issue
25 with what the -1 says in that respect in terms of

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1 flailing?

2 A. No, sir.

3 Q. If you were ejected at 200 to 250 knots,
4 you would not expect flailing; correct?

5 A. That's correct. I would not expect
6 flailing injuries, but there could be a lot of
7 other injuries involved.

8 Q. Now, in paragraph -- excuse me.
9 Question and Answer 45 of your testimony, you refer
10 to the four pilots that you talked to with respect
11 to ejecting from an accident. Correct? Question
12 and Answer 45? Excuse me. Question and Answer 46.

13 A. Yes.

14 Q. And you understand the basis of what's
15 been referred to here as the R failure, the R
16 reduction factor?

17 A. Yes.

18 Q. There's two component to that. The
19 first component is whether or not the pilot is in
20 control of a plane with time and capability to
21 avoid. Correct?

22 A. Yes.

23 Q. And Generals Cole, Jefferson, and
24 Colonel Fly, based upon their review of the
25 accident reports, determined that was 90 percent;

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1 correct?

2 A. That's their testimony.

3 Q. And then the second component of that
4 factor is with respect to those pilots that are in
5 control and with the timing and capability to
6 avoid, 95 percent of them would, in fact, avoid a
7 site such as the PFSF. That's the second part of
8 that factor. Correct, as you understand it?

9 A. That's their testimony.

10 Q. Now, therefore, in determining the
11 extent to which a pilot is in control, the extent
12 to which a pilot in control of a plane would avoid
13 a site -- you really are only focusing on those
14 pilots that are in control of their plane.

15 Correct?

16 A. Yes. The pilots not in control of their
17 plane don't get to vote.

18 Q. For pilots not in control, you don't
19 need to worry about the second part of the factor.

20 Correct?

21 A. That are not in control, that's correct.

22 Q. Now, with respect to your accidents, the
23 four accidents that you list in your Question and
24 Answer 46, I'd like to just kind of briefly go
25 through those with you in that context. Let's

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1 start with Colonel Coots?

2 A. Yes.

3 Q. And he is currently assigned to the
4 388th Fighter Wing at Hill Air Force Base?

5 A. Yes.

6 Q. And you refer to an accident that he had
7 with an F-111 in the United Kingdom.

8 A. Yes.

9 Q. And where you describe it you say that
10 he was on a final approach at 150 feet AGL at 150
11 knots indicated air speed?

12 A. Yes.

13 Q. And so therefore I take it he was just
14 about ready to land on the runway? Is that
15 correct?

16 A. Yes.

17 Q. And then you say he encountered
18 hydraulic failure?

19 A. Yes.

20 Q. And that was total hydraulic failure, as
21 you understand it?

22 A. It is irrelevant. Enough to put the
23 aircraft in a position that he was uncomfortable.

24 Q. And did he tell you he was in control of
25 the aircraft or out of control?

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1 A. He said he was not in control of the
2 aircraft.

3 Q. Out of control?

4 A. Out of control.

5 Q. So therefore that accident wouldn't be
6 relevant to the 95 percent determination that
7 Generals Cole and Jefferson and Colonel Fly made
8 with respect to pilots who are in control of the
9 plane being able to avoid --

10 A. That's correct.

11 Q. -- avoid a site. Okay. With respect to
12 the -- let's go to the third accident, or
13 backwards, probably. You refer to a Lieutenant
14 Tidgewell, who ejected from an F-16 on October 17,
15 2001, Hill Air Force Base. His F-16 was on the
16 runway travelling at 150 knots indicated air speed
17 when it encountered a tire separation. What do you
18 mean by a tire separation?

19 A. Front tire blew.

20 Q. And was he in control of the plane?

21 A. Yes.

22 Q. In what respect?

23 A. He had flyable air speed. It was a
24 flyable airplane. And he elected at that time to
25 try and control it on the ground. It was a

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1 perfectly flyable airplane.

2 Q. The plane never took off the ground?

3 A. He elected to abort.

4 Q. Did the plane take off the ground?

5 A. If you elect to abort, the plane doesn't
6 take off.

7 Q. I'm not used to all the terminologies.

8 A. Okay.

9 Q. So that was that situation where the
10 plane did not leave the ground. Would that be
11 relevant, therefore?

12 A. I think it is perfectly relevant.

13 Q. Okay. With respect to the second
14 accident up at Cold Lake, Canada. This person was
15 flying an F-16 at 1700 feet AGL?

16 A. Yes.

17 Q. And he was flying at 540 knots indicated
18 air speed?

19 A. Yes.

20 Q. First of all, was he on a training
21 range, restricted area during maneuvers?

22 A. He was on a training mission at Cold
23 Lake.

24 Q. And 540 knots indicated air speed is
25 faster than what one travels or transits through

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1 Skull Valley, correct?

2 A. No. Not necessarily. I have flown
3 through Skull Valley at 500 knots trying to catch
4 up to my formation.

5 Q. So it's typical speed when flying
6 through Skull Valley at 400 to 450 knots typical
7 air speed?

8 A. That is a typical air speed.

9 Q. Now, with respect to the accident, he
10 encountered a bird and what happened?

11 A. It impacted his canopy, which broke his
12 heads-up display, causing a temporary loss of
13 vision. He couldn't see, wind blast, and he
14 ejected.

15 Q. So he was not in control of the plane?

16 A. He was in perfectly good control of the
17 plane. He elected to leave.

18 Q. With respect to the first accident,
19 okay, the one in Belgium. That person was flying
20 above the cloud cover of approximately 4000 feet
21 AGL; is that correct?

22 A. I don't remember the altitude exactly.
23 I think that's a good characterization.

24 Q. Approximately at that altitude AGL;
25 correct?

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1 A. Yes.

2 Q. And isn't it true that in that part of
3 Belgium you have rolling hills and a fair amount of
4 villages?

5 A. In some parts, yes. In some parts it is
6 completely rural.

7 Q. You would, nevertheless, agree that the
8 terrain in Belgium differed significantly from that
9 in Skull Valley?

10 A. Yes.

11 Q. And you agree the population in Belgium
12 would be greater than that in Skull Valley;
13 correct?

14 A. In some parts.

15 Q. And you would agree, also, in Skull
16 Valley that at 4000 feet AGL, you would be able to
17 see the peaks of at least the Stansbury Mountains?

18 A. It depends on the weather. I don't
19 agree with that at all.

20 Q. Well, if he was flying above -- in that
21 situation where he was flying above an overcast of
22 4000 feet AGL?

23 A. I don't know what the weather was to his
24 left or right. I didn't ask. I just knew that he
25 was above the clouds, so I can't speculate on that.

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1 Q. What did you precisely ask, was it Major
2 Smith?

3 A. It was Captain at the time. It is Major
4 now. Which time? I spoke when he got off the
5 rescue helicopter and I have spoken to him a
6 hundred times since then.

7 Q. When did you speak to him just before
8 you wrote this declaration?

9 A. I think the last time I spoke to him was
10 a couple months before this. And I asked him to
11 briefly explain, yet again, the circumstances
12 surrounding his ejection. And I didn't caveat it
13 to anything. He explained it.

14 Q. With respect to Lieutenant Tidgewell,
15 when did you speak to him and what did you ask him?

16 A. I spoke to the other three on the same
17 day, and I'm not sure if the date is in here. It
18 was, I believe, in January of this year.

19 Q. And what precisely did you ask them?

20 A. I asked all three the same questions; if
21 they would explain the circumstances and activities
22 surrounding their ejection. And I asked them to
23 include their flight parameters which would include
24 air speed, attitude, altitude, G-forces, all of
25 those types of things.

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1 Q. And in terms of, say, Lieutenant
2 Tidgewell, did you ask him whether he was in
3 control or whether he thought he was in control of
4 the plane?

5 A. I did. After he explained his accident.

6 Q. And did you ask the same of Captain, is
7 it Petrow--

8 A. I did.

9 Q. And what did he tell you?

10 A. He said it was a flyable airplane. He
11 elected to jump out.

12 Q. And what is the terrain around Cold
13 Lake, Canada?

14 A. As described this morning, it is
15 relatively flat. There's some large bodies of
16 water. Rolling hills. There are some towns,
17 medium -- well, not medium. 5000 people or so. A
18 town just south of it. The base has a population
19 of a few thousand people, as well.

20 Q. And I think we have heard this morning
21 that generally, at least the way he recalled it
22 this morning, he was flying 30 or 40 miles from the
23 populated area?

24 A. That's correct.

25 Q. Going back to the incident, the accident

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1 in Belgium, do you know what the accident report
2 said in terms of cloud cover nearby?

3 A. There was cloud cover underneath him.

4 Q. What did it say to the mile to the west
5 or east of him, or a couple miles to the west or
6 east?

7 A. It didn't say anything, so I'm not going
8 to assume it said anything.

9 Q. Okay. Now, you said here that I think
10 in your testimony that -- you said when you
11 explained the accident to me in terms of the
12 incident up in Cold Lake, Canada that the captain
13 lost his vision. So he lost his ability to see in
14 that instance; correct?

15 A. Temporarily.

16 Q. Do you know how long he lost his vision?

17 A. I did not ask him.

18 Q. If a plane is flyable but the person
19 flying it can't control it, isn't that the same
20 thing as essentially an uncontrollable plane?

21 A. Absolutely not.

22 Q. Did you ask him at what point in time he
23 ejected in the --

24 A. I did. And it was immediately after the
25 bird hit him. Would you like me to expand on the

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1 previous answer? You looked like you were going to
2 ask another question.

3 Q. No, I wasn't.

4 A. Okay.

5 Q. In your prefiled testimony, Lt. Colonel
6 Horstman, in response to Question 10, you state
7 that air-to-air combat trainee and major exercises
8 are authorized and conducted in the Sevier B
9 military operating area. Now, the Sevier B, do you
10 see that?

11 A. Which paragraph, please?

12 Q. Question and Answer number 10. Down at
13 the -- let's see. It's the third paragraph.

14 A. Okay.

15 Q. Do you see that?

16 A. I do.

17 Q. Now, it's true, as we have discussed
18 here previously, that the Sevier B MOA extends
19 south of Skull Valley?

20 A. Yes.

21 Q. And Skull Valley is just a small part of
22 the Sevier B MOA?

23 A. Yes.

24 Q. And it's also true that air-to-air
25 combat training does not take place in Skull Valley

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1 where the site would be located; correct?

2 A. That's correct.

3 Q. And, in fact, I think it is in Answer
4 20, Question and Answer 20, you described generally
5 what takes place on flights through Skull Valley.

6 A. Yes.

7 Q. And none of those involve air-to-air
8 combat training; correct?

9 A. That's correct.

10 Q. Now, isn't it true that the type of
11 activities that you described in Question and
12 Answer 20 that take place in Skull Valley are what
13 you would call routine administrative phases of
14 flight?

15 A. Some are, yes. G-awareness turns are
16 not administrative routine flights.

17 Q. You don't think they are?

18 A. No.

19 Q. Let me ask you this: Do you remember
20 when I asked you in your deposition on December 11
21 whether you agreed that the activities taking place
22 in Skull Valley were administrative routine, and
23 you said yes?

24 A. I don't remember the exact wording.

25 Q. Let me show you your deposition for that

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1 day.

2 MR. SILBERG: While we are doing that,
3 off the record?

4 JUDGE FARRAR: Yes, sir. Let's take a
5 ten-minute break.

6 (A break was taken.)

7 JUDGE FARRAR: Back on the record, Mr.
8 Turk, you had indicated at one point that your
9 witnesses were not too sure about some of the
10 precise import of some of the questions Judge Kline
11 had asked, that it might benefit them to have a
12 little review of that. Do you want to direct that?

13 MR. TURK: I would simply note that we
14 thought we understood Judge Kline's interest in
15 seeing if we could come to some sort of a more
16 realistic evaluation of aircraft crash hazard.
17 Just to be sure we are capturing the kinds of
18 elements Judge Kline wants us to think about, I
19 would ask if he would restate what he is interested
20 in seeing.

21 JUDGE FARRAR: As long as it is clear
22 that those were his thoughts and inquiries and he
23 is not requesting or directing or suggesting that
24 the Staff do anything.

25 MR. TURK: We understand this will be

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1 our own independent attempt to try to respond to
2 his inquiry.

3 MR. SOPER: I might just ask, before we
4 get too far into it, to be introduced as part of
5 this proceeding for testimony and cross-examination
6 and so forth or just as a beside-the-point.

7 JUDGE FARRAR: In other words, he asked
8 some questions of the witnesses. The Staff is
9 interested in those questions. What they choose to
10 do with those questions is their business. And
11 this is an adversarial proceeding so whatever they
12 choose to do with something, they would have to go
13 through you.

14 MR. SOPER: Okay. I see. I didn't know
15 if we were anticipating more evidence based on
16 these questions as part of this proceeding.

17 JUDGE FARRAR: I don't know what they
18 are anticipating. All I know is that the witnesses
19 were interested in the questions and would like to
20 make sure they understand them. And we thought it
21 would be good to do it. As long as they are here,
22 we would do that. Go ahead, Judge Kline.

23 MR. TURK: Your Honor, we would be
24 interested in making sure we capture, in doing this
25 analysis, what it is you are interested in

1 observing.

2 MR. KLINE: My questions are intended
3 only to thoroughly ventilate the issue. That's my
4 role on this. That's why there's scientists on the
5 licensing board. My questions to the Staff panel
6 concerning the R factor reflected my hypothesis
7 that there may be a problem with the model related
8 to the fact that the R factor appeared to be
9 unweighted; that is, it was an unweighted
10 calculation. And it appeared to me that the Staff
11 had, in a way, recognized that with or by producing
12 an analytically equivalent result to weighting the
13 R factor, which would be discounting the N factor
14 in the equation for aircraft that weren't likely to
15 be a threat to the site. So those were my
16 perceptions of what I thought might need remedy in
17 the model.

18 Now, I don't sit here to assist anybody
19 in their case and so we are not requiring anybody
20 to do anything if they don't want to. But it does,
21 it seemed to me, and your own technical experts are
22 free to disagree if you want to, does seem that
23 there's no need for a weighting factor. You know,
24 I just really -- as I say, ventilate the issue.
25 And it looked that way to me. So you decide for

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1 yourselves whether you want to submit a weighted
2 estimate or whether it is possible to submit a
3 weighted estimate, or what it is you want to do
4 about it.

5 JUDGE LAM: And let me add --

6 MR. KLINE: Which could include doing
7 nothing.

8 JUDGE LAM: With Judge Kline's
9 permission, let me add a word of caution to what
10 the Staff is thinking about doing. The analogy
11 here is if somebody is doing a risk assessment of
12 automobile crash probability on a four-lane
13 highway, all of the sudden somebody now came
14 forward and said to you, "Aha, I had a four car
15 formation in which I would propose one of the lanes
16 would be totally absent of any traffic," and come
17 up with a major reduction of the risk. That
18 approach would require a great deal of additional
19 scrutiny because the formation, I do not know how
20 reliable that formation information is. Is there
21 any prohibition as to violating the formation? On
22 a four-lane highway traffic pattern one could
23 perhaps say, you allow there is an HOV lane
24 prohibition of one-driver traffic; therefore, I
25 want to impose additional constraints and

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1 restraining to the study.

2 But what I am hearing is somebody is
3 thinking about, and correct me if I'm wrong,
4 thinking about formations where we would really be
5 able to eliminate a fraction, not an insignificant
6 fraction, of the traffic, thereby resulting in a
7 not insignificant reduction in the risk. If I said
8 insignificant earlier, I meant not an insignificant
9 fraction. Just a word of caution to the Staff or
10 anybody who is thinking about responding to Judge
11 Kline's remark.

12 JUDGE FARRAR: Mr. Soper, do you want to
13 say anything at this point?

14 MR. SOPER: No. I think wasn't that Mr.
15 Turk's purpose of his inquiry just to get that
16 assistance, explanation from the judges?

17 JUDGE FARRAR: That's a clarification of
18 what my colleagues were thinking and as far as we
19 are concerned, that's all it is; the thinking that
20 was behind their questions.

21 MR. SOPER: I see. Thank you.

22 MR. TURK: Thank you very much, your
23 Honor. It may be to do that kind of analysis would
24 be beyond our limit at this late time without data
25 and equipment to help. We will advise in the

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1 morning.

2 JUDGE FARRAR: And that's your business.
3 What you choose to do with this information is
4 entirely your business.

5 MR. TURK: Thank you.

6 JUDGE FARRAR: Mr. Gaukler, the ball is
7 back in your court after a longer break than I
8 would have thought. But it is now, just for the
9 record, a quarter to 9:00, and we are ready to go.

10 MR. GAUKLER: You should have been
11 handed a copy of your December 11 deposition. Oh.
12 Page 52 through 54. This is not an exhibit. I'm
13 just handing it out. I'll just be referring to it
14 off and on in the examination.

15 JUDGE FARRAR: What pages did you say,
16 Mr. Gaukler?

17 MR. GAUKLER: Looking at specifically
18 Page 53. To get some background you have to go
19 back to about page 50, 51.

20 JUDGE FARRAR: Okay. Thank you.

21 Q. (By Mr. Gaukler) Have you had a chance
22 to look at that?

23 A. Yes.

24 Q. We were talking there about the type of
25 flight activities that take place in Skull Valley;

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1 correct?

2 A. Yes.

3 Q. And if you look at Page 53, you were
4 talking about G-awareness terms. And I asked you:

5 "So the G-awareness test would be part
6 of the warm-up exercise you would do?"

7 You said, "Uh-huh (affirmative). Yes."

8 "And Colonel Fly has referred to this
9 flight as the administrative routine flight. Would
10 you agree with that then?"

11 And you said, "I would." Correct?

12 A. That's what it says.

13 Q. And also, later in the deposition, if
14 you look at Page 204 of the deposition, there I
15 asked you whether or not you agree with Colonel Fly
16 that, "Engine failures are virtually the only
17 reason you expect any F-16 crashes in Skull Valley.
18 Do you agree with that?"

19 And you say, "Virtually, yeah. The only
20 other one that I could think of would be a bird
21 strike, and whether it hit -- if it hit the engine
22 it would be an engine failure. If it hit the
23 canopy, it wouldn't. But for all the other types
24 of failures, no, I agree; with the exception of the
25 bird strike." So you did not mention G-LOC there,

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1 did you?

2 A. It's not mentioned in the testimony.

3 Q. I'd like to hand out what is Tab F to
4 the air crash report, just for your information.
5 The aircraft report is, as your Honors know, PFS
6 Exhibit N.

7 I have shown you what is Tab F to the
8 air crash report and can you identify this for me,
9 please Lt. Colonel Horstman?

10 A. Yes. It's a Department of Air Force
11 Headquarters Air Combat Command, October 1999.
12 Subject is G-awareness turns and low level flying.

13 Q. And it's from the Headquarters of Air
14 Combat Command, it states?

15 A. That's what I said.

16 Q. And what is Air Combat Command?

17 A. Air Combat Command is the administrative
18 headquarters for all combat flying forces for the
19 Air Force inside the continental United States.

20 Q. And this is from the chief of safety for
21 Air Combat Command, this memorandum is?

22 A. Yes, it is.

23 Q. So he is the chief of safety for this
24 portion of the Air Force?

25 A. Yes, he is.

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1 Q. And he says in that first paragraph,
2 does he not, that, "The G-awareness turns are not
3 high risk but merely a warm-up exercise to check
4 your equipment and body tolerance for that
5 particular day. These are normal operations
6 accomplished before entry."

7 A. Yes. And if we will go back to your
8 question, it was whether they were administrative
9 in nature. And they are not administrative.

10 Q. But they are normal operations to
11 accomplish before range entry and they are not high
12 risk. Would you agree with Colonel Alston in that
13 respect? Correct?

14 A. I do agree with that respect.

15 Q. Okay. Also, to -- I'd like to have you
16 look at Question and Answer 84 on Page 32 of your
17 testimony. And there you claim pilots may conduct
18 G-awareness turns in Skull Valley which apply 3G to
19 4G on a pilot. And you refer to potential
20 accidents from G-LOC. And you cite a May 25, 1990
21 accident.

22 A. Yes.

23 Q. And that's an accident involving the one
24 at Moody Air Force Base?

25 A. Yes.

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1 Q. I'd like to hand out that accident
2 report.

3 JUDGE FARRAR: Mr. Gaukler, while we are
4 doing this, this October 15, 1999 document you were
5 just talking about, that's the one that's from
6 Exhibit N?

7 MR. GAUKLER: That's from Tab F to PFS
8 Exhibit N, Air Crash Report.

9 JUDGE FARRAR: And this new thing is to
10 be --

11 MR. GAUKLER: I'm just going to refer to
12 it. I'm not going to have it marked or entered.

13 JUDGE FARRAR: Okay. Take a second to
14 review this May 25, 1990 accident. I'm going to be
15 focusing my questions on the flight portion of it,
16 which begins on Page 2 and basically goes over to
17 Page 3, and then the Impact Section on Page 3.

18 A. Okay.

19 Q. It's your testimony that this accident
20 involves G-LOC?

21 A. It is.

22 Q. And could you briefly describe for
23 purposes of the Board what is meant by G-LOC?

24 A. G-induced loss of consciousness. And it
25 happens when the brain loses enough oxygen, and

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1 that occurs because the blood flow from the heart
2 to your brain is reduced by G forces. For a
3 nonfighter pilot, two G forces would be an
4 aggressive roller coaster ride. Four G forces is
5 enough for anybody without training to have a G
6 induced loss of consciousness, to pass out,
7 essentially. Anything above that is obviously more
8 dangerous. And it can occur much more quickly, the
9 actual onset of G-induced loss of consciousness can
10 occur much, much more quickly the quicker the onset
11 of the Gs, or the more Gs. G-induced loss of
12 consciousness, it happens to fighter pilots. It
13 happens unfortunately on a very frequent basis.
14 Numerous people have been killed. Some of them are
15 in very high stress environments, and by that I
16 mean high performance, very high G-load engineer
17 craft, and some are lower G-load, but they are just
18 not quite ready. So it can happen as low as 3 Gs
19 but typically it takes 4 or more Gs for that to
20 occur.

21 Q. And when you say in terms of high
22 performance or high stress levels, usually G-LOC
23 occurs in training in the restricted area such as
24 air-to-air combat training, et cetera. Correct?

25 A. Usually it does, yes.

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1 Q. And that's where you would expect G-LOC
2 to occur in those type of circumstances?

3 A. No. I would expect it to occur there
4 but I -- the reason that you wear a G suit and
5 combat vest and a mask that has pressure in it is
6 so that you can reduce the effects of the G-forces
7 on your body. In a G-awareness turn, there's two
8 turns, typically two. There could be three or
9 more. The first one is three to four Gs and the
10 second turn is four to five Gs. And sometimes if
11 you are going to do really high performance, you
12 will want to do one that is six to 6.5 Gs,
13 potentially. So you are always doing G-awareness
14 turns. It's a requirement for every sortie. And
15 you check not only whether your airplane is ready
16 and can provide you with the support, whether your
17 life vest -- not your life vest. Whether your
18 combat vest, your G suit, your mask, and your body
19 are all prepared that day, for example, for the Gs.

20 As another example, in Germany when I
21 went up to fly an air-to-ground mission, one of the
22 instructors in our squadron, we did the G warm-up
23 exercise and he called to knock it off. And I
24 said, "What's wrong?" And he said, "I can't do Gs
25 today." So we changed our instrument, flew

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1 instrument procedures, some approaches. No high
2 performance or medium performance maneuvering
3 whatsoever.

4 Q. Now, with the G-LOC, when somebody
5 undergoes G-LOC, they lose consciousness for a
6 period of time?

7 A. Yes. And the Air Force studies have
8 revealed that that length of time is typically -- I
9 want to say 23 seconds but it depends on the
10 individual, et cetera.

11 Q. And when a person goes into G-LOC
12 usually the plane, he doesn't touch the controls,
13 the plane usually continues in the same route?

14 A. He is asleep.

15 Q. Now, if you look at this accident here,
16 look at Page 3, okay?

17 A. Okay.

18 Q. And it refers to Auto 2. In this
19 instance Auto 2 was the plane that had the
20 accident; correct?

21 A. That's correct.

22 Q. And he was making a turn, a low level
23 turn. Correct? If you look at the previous page,
24 I believe --

25 A. He was turning, yes.

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1 Q. Okay. And it says he completed his turn
2 heading in 300 degrees and immediately impacted the
3 ground.

4 A. It says that.

5 Q. And so he was in control of the plane at
6 that time he was turning the plane?

7 A. It didn't indicate that at all.

8 Q. Doesn't indicate that to you?

9 A. No. To me what this indicates is that
10 while he was turning the aircraft, the pilot had
11 G-induced loss of consciousness, and because of the
12 way the flight controls on this aircraft work, as
13 has been discussed earlier, it is going to stop
14 turning.

15 Q. It says he completed his turn and then
16 it impacted the ground. So he had completed his
17 turn, according to this description in your
18 investigation.

19 A. That is correct. What was his angle of
20 bank? And when you look at that, that's why we
21 have drawn the conclusion that it is a G-induced
22 loss of consciousness.

23 Q. And then you look at the end of the last
24 statement in Paragraph 5, Impact. Would you read
25 that for the Board, please?

1 A. Both feet on the rudder pedals, right
2 hand on the control, left hand off the throttle at
3 the time of the impact.

4 Q. So it would show that he was conscious
5 at the time of the impact; correct?

6 A. That's correct. And when you have a
7 G-induced loss of consciousness, your G-induced
8 loss of consciousness will last for a certain
9 amount of time. Then you regain consciousness at a
10 rate that is different for everyone and -- I should
11 back up and explain when you lose consciousness.
12 One of the warning signals when you are maneuvering
13 aircraft for G-forces is you lose your vision. You
14 can continue to think and perform and fly, but you
15 can't see, because your eyes lose the oxygen before
16 your brain. So it is no surprise that he could be
17 conscious or appear to be conscious when he
18 impacted the ground.

19 Q. Now, does this accident report anywhere
20 reference G-LOC or say the accident was caused by
21 G-LOC?

22 A. Not on this particular paper.

23 Q. I want to have marked -- I guess I would
24 like to identify this document as an exhibit and
25 make it PFS Exhibit 80. And I would move for its

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1 admission.

2 JUDGE FARRAR: Let's take a moment.

3 MR. GAUKLER: I gave 79 this morning,
4 and assuming nothing happened in my absence since,
5 it will be 80.

6 (A break was taken.)

7 MR. GAUKLER: Let's mark 81 at the same
8 time.

9 JUDGE FARRAR: What is 81?

10 MR. GAUKLER: An e-mail to Jack Cole
11 from Paul Cormier at the Pentagon concerning a FOIA
12 request.

13 COL. HORSTMAN: I'd like to follow up,
14 if I could.

15 JUDGE FARRAR: Wait a minute. We are
16 going off the record.

17 (APPLICANT'S EXHIBITS-80 AND
18 81 WERE MARKED.)

19 JUDGE FARRAR: We have the exhibits
20 marked and you had wanted to move on and your
21 witness wanted to say something. Not your witness.
22 The witness.

23 A. The accident report that we have here
24 doesn't say a lot of things. It doesn't say that
25 Colonel Crebs was on vacation for two weeks before

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1 the accident. And it doesn't describe the reason
2 for the accident. As you have heard, there's two
3 different type of reports, the Safety Report and
4 Accident Report. And most of the reports that you
5 have seen, unless it is a mechanical failure, they
6 don't tell you what happened. So based on our
7 conclusion and knowledge of the incident
8 previously, we have concluded it is a G-induced
9 loss of consciousness.

10 Q. Who is "we" in that answer?

11 A. The State of Utah.

12 Q. And who specifically when you talk about
13 "we"?

14 A. I am the expert witness and I'm speaking
15 on behalf of the state of Utah.

16 JUDGE FARRAR: Mr. Gaukler means you
17 said you did some follow-up. Who is the "we" who
18 did the follow-up?

19 COL. HORSTMAN: It is me.

20 JUDGE FARRAR: Okay. And how -- tell
21 me -- it's late in the day. Which report is this
22 in terms of one is public and usable and one is
23 confidential not to be used by anybody?

24 COL. HORSTMAN: That's correct.

25 JUDGE FARRAR: Which is the one we have

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1 here?

2 COL. HORSTMAN: This is the public
3 usable one.

4 JUDGE FARRAR: So is one way that you
5 find out what really happened is you would get your
6 hands on the other one? Or can you not get your
7 hands on that?

8 COL. HORSTMAN: Well, you can't. But
9 having been an officer before and a pilot, I have
10 seen virtually all of these before. The commander
11 of Air Combat Command, who the chief of safety
12 works for, told me the day after the accident board
13 conclusion was over, that Colonel Crebs was killed
14 due to G-induced loss of consciousness.

15 JUDGE FARRAR: Why do I not immediately
16 see Colonel Krebs's name in here?

17 COL. HORSTMAN: It's on Page 1, three
18 lines from the bottom.

19 JUDGE FARRAR: Okay. And what does him
20 being on vacation have to do with anything?

21 COL. HORSTMAN: The G-induced loss of
22 consciousness is a very -- you train for that. It
23 is perishable. If you have gone out four days in a
24 row and flown high performance, the fifth day would
25 be easier. If you have taken two weeks off, you

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1 have to be ready for it again.

2 JUDGE FARRAR: Mr. Gaukler, you wanted
3 to move the admission of PFS 80?

4 MR. GAUKLER: Yes.

5 JUDGE LAM: 81.

6 JUDGE FARRAR: We haven't done anything
7 with 81 yet.

8 MR. GAUKLER: Not yet.

9 MR. SOPER: No objection.

10 MS. MARCO: No objection.

11 JUDGE FARRAR: Then 80 will be admitted.

12 (APPLICANT'S EXHIBIT-80 WAS ADMITTED.)

13 Q. (By Mr. Gaukler) Lt. Colonel Horstman,
14 isn't it true that a lot of these other public
15 accident reports that we have when G-LOC is the
16 cause of the accident specifically refer to G-LOC?

17 A. No. Many, many, many of these accidents
18 don't say a cause.

19 Q. Have you reviewed accident reports that
20 we provided to you, public accident reports that we
21 provided to you or provided the State as part of
22 this case where it specifically refers to G-LOC as
23 being the cause of the accident, or being involved
24 in the accident?

25 A. I don't recall.

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1 Q. I would like to have you take a look --
2 do you have the air crash report handy, by any
3 chance?

4 A. Not in front of me, no.

5 JUDGE FARRAR: Mr. Gaukler, before we
6 move forward, we just admitted PFS 80 and it is
7 late in the day and I'm not sure what the purpose
8 of this is. I haven't connected in my mind G-LOC
9 and Colonel Crebs and anything that is at issue.

10 MR. GAUKLER: First of all, he says that
11 G-LOC, I'm pointing out that G-LOC wasn't stated in
12 this accident report, public accident report, and
13 he was saying that you have to go to the safety,
14 the confidential safety report --

15 JUDGE FARRAR: Why do we care about this
16 accident report?

17 MR. GAUKLER: He is claiming that G-LOC
18 is the type of incident that could occur in Skull
19 Valley.

20 JUDGE FARRAR: All right. Isn't it
21 true --

22 MR. GAUKLER: Excuse me. Your Honor, I
23 think it is getting late in the day. Let me go
24 through this Exhibit 81 and I would think that it
25 might be time to call it quits.

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1 JUDGE FARRAR: Oh, no. We wasted all
2 that time eating so we could keep going.

3 MR. GAUKLER: I can go for a while yet,
4 if your Honor wants to.

5 Q. (By Mr. Gaukler) In terms of -- if you
6 look at number -- at what I have identified as PFS
7 Exhibit 81, it's an e-mail from Mr. Paul Cormier of
8 the Pentagon in response to a Freedom of
9 Information Act request from Jack Cole. Do you see
10 that?

11 A. I do.

12 Q. And it states this is in response to
13 your FOIA request dated November 20, 2001 for a
14 copy of an AIB Investigation involving a mishap out
15 at Moody Air Force Base involving G-LOC.

16 A. It is.

17 Q. And if you recall, in our deposition in
18 July of 2001, we were discussing or you mentioned
19 that you had identified an accident with respect to
20 G-induced loss of consciousness in Skull Valley.
21 Isn't that correct?

22 A. Yes.

23 Q. G-induced loss of consciousness not in
24 Skull Valley but what you thought was applicable to
25 Skull Valley?

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1 A. Yes.

2 Q. And you could not identify that accident
3 report at that time, could you?

4 A. That's correct.

5 Q. And therefore you were going to try to
6 get back to us with whatever the accident report
7 was. Correct?

8 A. I believe so.

9 Q. Yeah. We asked for a Freedom of
10 Information Act request and asked for a two-year
11 period, and doesn't this second paragraph identify
12 three accidents that occurred in the period of time
13 for fiscal years 1990, '91, and '92 out of Moody?
14 And is one of those three such instances identified
15 in this letter the May 25, 1990 incident?

16 A. One of them is. I think the years '90
17 and '91.

18 Q. But one of the three instances
19 identified is the May 25, 1990 accident that we
20 just were talking about?

21 A. It is.

22 Q. And doesn't the letter state that none
23 of these mishaps involved a G-induced loss of
24 consciousness, including the May 25, 1990 --

25 A. Yes. And it is confusing to me because

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1 I don't know why a four-star general would tell me
2 that it was a G-induced loss of consciousness.

3 Q. Did you ever see any documentation that
4 it was a G-induced loss of consciousness?

5 A. I did not ask the four-star to write me
6 a letter, no. I'm sorry.

7 Q. And he didn't give you the Safety
8 Accident Report, the confidential one, in this
9 instance?

10 A. As I have said, I have seen most of
11 them. Since I retired from the Air Force, I have
12 not had access to any of them. So the answer is
13 no.

14 Q. You did not see this one, in other
15 words?

16 A. When I was on active duty I may have. I
17 did not piece them together.

18 Q. So your testimony that this is G-LOC
19 would not be related to any review that you did
20 prior to your retirement? Is that correct?

21 A. It would be because the commander of Air
22 Combat Command told me that that's what it was.

23 Q. So it wouldn't be due to any review of a
24 Safety Investigation Accident Report that you did
25 prior to your retirement? Yes or no?

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1 A. No.

2 JUDGE FARRAR: Mr. Gaukler, I owe you an
3 apology. I think I did say earlier that the first
4 person who puts up their hand and says they quit,
5 we will quit. So if you are ready to do that. But
6 probably because of the lateness of the hour, I'm
7 still unable to connect, why are we into G-LOC in
8 the first place? Was it in Colonel Horstman's
9 testimony?

10 MR. GAUKLER: Yes, it was.

11 JUDGE FARRAR: As a possible cause of
12 accidents in Skull Valley?

13 MR. GAUKLER: That's correct. If you
14 read the first part of it --

15 JUDGE FARRAR: Somehow I --

16 MR. GAUKLER: There's a question and
17 answer on, I think it is 84. You made that
18 statement --

19 JUDGE FARRAR: Paragraph 84?

20 MR. TURK: Answer 84.

21 JUDGE FARRAR: I'm sorry. I have the
22 wrong document.

23 MR. GAUKLER: Question and Answer 84,
24 the prefiled testimony. The question is, "Explain
25 why --"

1 JUDGE FARRAR: Let me -- I got it.
2 Okay. And according to Question 85, we will get
3 into birds later. When you referred us to Page 204
4 and 205 of the deposition there was some very
5 interesting things there that I wasn't previously
6 aware of.

7 MR. GAUKLER: Yes, your Honor.

8 JUDGE FARRAR: Okay.

9 MR. GAUKLER: I would move for the
10 admission of PFS 81.

11 JUDGE FARRAR: Any objection?

12 MS. MARCO: No.

13 MR. SOPER: No objection, your Honor.

14 JUDGE FARRAR: All right. Then that
15 will be admitted.

16 (APPLICANT'S EXHIBIT-81 WAS ADMITTED.)

17 JUDGE FARRAR: Is there anyone who
18 desperately wants to stay here any longer?

19 MR. TURK: At my own peril, I'd like to
20 ask for one clarification of a question and answer.
21 I believe Mr. Gaukler was correcting the question
22 but I heard an answer to the incorrect version as
23 well as the correct version. And it had to do with
24 whether, in the July 2001 deposition, Lt. Colonel
25 Horstman said there was a G-LOC accident event in

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1 Skull Valley versus a type of event that could
2 occur in Skull Valley. I wanted to know which is
3 the correct question and answer.

4 JUDGE FARRAR: Colonel Horstman, let's
5 simplify it. Tell us the answer to the right
6 question.

7 COL. HORSTMAN: It did not happen in
8 Skull Valley.

9 MR. TURK: It did not.

10 COL. HORSTMAN: No. Not particularly in
11 Skull Valley. I answered the question too quickly.

12 MR. GAUKLER: I may have asked the wrong
13 question.

14 JUDGE FARRAR: It's clear that
15 everyone -- in fact, we may have to have the
16 reporter strike the last five minutes of
17 everybody's testimony. We have reached a point of
18 diminishing returns. Thank you all. We have been
19 at it over twelve and a quarter hours. That should
20 be long enough. We are set for nine o'clock here
21 tomorrow morning, and we are going to make every
22 effort to finish the proceeding.

23
24 (The proceeding was concluded
25 for the day at 9:20 p.m.)

CERTIFICATE

This is to certify that the attached proceedings
before the United States Nuclear Regulatory Commission
in the matter of:

Name of Proceeding: Private Fuel Storage, LLC

Docket Number: Docket No. 72-22-ISFSI

ASLBP No. 97-732-02-ISFSI

Location: Salt Lake City, Utah

were held as herein appears, and that this is the
original transcript thereof for the file of the United
States Nuclear Regulatory Commission taken by me and,
thereafter reduced to typewriting by me or under the
direction of the court reporting company, and that the
transcript is a true and accurate record of the
foregoing proceedings.

131 Diana Kent
Diana Kent
Official Reporter
Neal R. Gross & Co., Inc.