RAS 2570

DOCKETED
USNRC

December 30, 2000

'01 JAN -3 A10:05

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

APPLICANT'S MOTION FOR SUMMARY DISPOSITION OF UTAH CONTENTION K AND CONFEDERATED TRIBES CONTENTION B

Pursuant to 10 C.F.R. § 2.749 and the Atomic Safety and Licensing Board's ("Licensing Board" or "Board") Order of September 5, 2000,[1] Applicant Private Fuel Storage L.L.C. ("Applicant" or "PFS") files this motion for summary disposition of Contention Utah K/Confederated Tribes B – Inadequate Consideration of Credible Accidents, ("Utah K"). Summary disposition is warranted on the grounds that there exists no genuine issue as to any material fact relevant to the contention and, under the applicable Commission regulations, PFS is entitled to a decision as a matter of law. This motion is supported by a statement of material facts, the declarations of James Cole, Wayne Jefferson, Ronald Fly, George Wagner, David Girman, Jeffrey Johns, Stephen Vigeant, and George Carruth and depositions of State personnel.

I. STATEMENT OF THE ISSUES

Contention Utah K asserts that:

[1] Memorandum and Order (General Schedule Revision, Withdrawal of Contentions Utah H and Utah U, and Status of Contention Utah GG) (Sept. 5, 2000) at 2 (allowing PFS to file motions for summary disposition regarding any outstanding Utah K issues).

Template = SECY-041

SECY-02

> The Applicant has inadequately considered credible accidents caused by external events and facilities affecting the ISFSI, including the cumulative effects of the nearby hazardous waste and military testing facilities in the vicinity.

Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-99-39, 50 NRC 232, 240 (1999).[2] In admitting the contention, the Board limited the facilities to be considered to: 1) the Tekoi Rocket Engine Test facility, 2) Salt Lake City International Airport, 3) Dugway Proving Ground ("Dugway" or "DPG"), 4) Hill Air Force Base ("Hill" or "Hill AFB"), and 5) the Utah Test and Training Range ("UTTR"). LBP-99-35, supra note 3, 50 NRC at 182.

In August 1999, the Board granted in part and denied in part a PFS motion for partial summary disposition of Utah K. Id at 200-01. The Board granted the motion with respect to Dugway, except for 1) aircraft flights in and out of Michael Army Airfield on Dugway and 2) the firing of conventional ground weapons in military testing and training. Id. at 194, 200. It also granted the motion with respect to aircraft on the UTTR with "hung bombs" flying to and landing at Michael Army Airfield on DPG. Id. at 192, 194.

The Board found that the State had raised a litigable material factual dispute regarding the current training use, by Army and National Guard troops, of a multiple rocket launch system at the Wig Mountain site in the northwestern portion of DPG, with a range of 18 miles, which is sufficient to reach the Private Fuel Storage Facility ("PFSF"). Id. at

[2] The portions of Utah K as admitted that concerned wildfires and the intermodal transfer point (ITP) were dismissed by the Board in August and September 1999. Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-99-35, 50 NRC 180, 198-200, reconsideration denied, LBP-99-39, 50 NRC 232 (1999) (wildfires); LBP-99-39, 50 NRC at 236 (ITP).

193-94. The basis for the Board's finding was that despite the stringent safety precautions under which weapons are used, "it has not been established that [rockets] necessarily travel in the direction they are fired." LBP-99-39, 50 NRC at 237. The Board noted that the use of other ordnance on DPG, however, which does not have the range to reach the PFSF from DPG training exercise areas, "seemingly provides little or no support for the State's claims." Id. n.1. The Board also denied PFS's Utah K motion with respect to cruise missile hazards and hazards from aircraft flying to and from the Salt Lake City airport. LBP-99-35, 50 NRC at 200-01.

The Board deferred ruling on the hazards posed by military aircraft flights in the vicinity of the PFSF site, pending the NRC Staff taking a position on that issue. Id. at 183.[3] On September 29, 2000, the NRC Staff published the Safety Evaluation Report ("SER") for the PFSF[4] and took the position that there is reasonable assurance that weapons use on DPG, civilian or military aircraft crashes, and cruise missile testing on the UTTR would not pose a hazard to the facility. SER at 15-81, -101.

PFS moves for summary disposition of Utah K on the grounds that no genuine issue exists concerning any facts material to whether the use of the Army rocket system on DPG, aircraft accident hazards, or cruise missile hazards would credibly threaten to cause a release of radioactive material from the PFSF. Therefore, PFS is entitled to judgment as a matter of law.

---

[3] See Order (Granting Filing Extension Motions and Setting Schedule for Responses to Request for Admission of Late-filed Contention) (July 27, 1999) at 2.

[4] Safety Evaluation Report Concerning the Private Fuel Storage Facility, Docket No. 72-22 (Sept. 29, 2000).

II. PFS IS ENTITLED TO SUMMARY DISPOSITION WITH RESPECT TO AIRCRAFT ACCIDENT AND CRUISE MISSILE HAZARDS

A. Standard for Summary Disposition

PFS has previously set forth the relevant law governing summary disposition at some length, and the legal basis provided in that motion is incorporated by reference herein. See App.'s Mot. Sum. Disp. Utah C at 4-16 (April 21, 1999). PFS expects the State to file affidavits purporting to contain expert opinions in opposition to this motion and therefore the legal requirements concerning such, id. at 10-15, will be particularly relevant here. These requirements include 1) demonstration of the affiant as an expert, and 2) an explanation of facts and reasons in the affidavit supporting the affiant's expert's opinion.[5] An affidavit made on "information and belief" is insufficient,[6] as are mere un-supported conclusions.[7] As the Supreme Court has held, reliable expert opinion must be based on "more than subjective belief or unsupported speculation." Daubert v. Merrell Dow Pharmas., Inc., 509 U.S. 579, 590 (1993).

B. The Use of Military Ordnance on Dugway Proving Ground

PFS has specified the facts material to determining the hazard posed by the use of military ordnance on DPG. St. Mat. Facts. Military training exercises and the firing and testing of conventional weapons on DPG will not pose a hazard to the PFSF because 1) the firing of weapons is covered by stringent safety procedures, 2) the firing position closest to the PFSF is more than 15 miles away, 3) the ranges of the weapons—other than

---

[5] See Mid-State Fertilizer Co. v. Exchange Nat'l, 877 F.2d 1333, 1339 (7th Cir. 1989); Carolina Power & Light Company (Shearon Harris Nuclear Plant, Units 1 and 2), LBP-84-7, 19 NRC 432, 447 (1984).

[6] Columbia Pictures Industries, Inc. v. Professional Real Estate Investors, Inc., 944 F.2d 1525, 1529 (9th Cir. 1991), aff'd on other grounds, 508 U.S. 49 (1993).

[7] Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2), LBP-83-32A, 17 NRC 1170, 1177 (1983); LBP-99-35, 50 NRC at 194.

the Army Multiple Launch Rocket System ("MLRS")—are insufficient to reach the PFSF from DPG firing positions, and 4) the weapons are fired in directions away from the PFSF. Carruth Dec. ¶¶ 4, 6-8;[8] Matthews Dep. at 13-22.[9] Thus, it is not credible that a conventional munition fired from Dugway would strike the PFSF.[10] Carruth Dec. ¶ 9.

Specifically with respect to the MLRS, the U.S. Army field manual on the MLRS clearly delineates the area that is at risk from the firing of the rockets. Id. at ¶ 10. The maximum range of the rockets is 20 miles and the area at risk extends to either side of the line on which the rockets are fired for a maximum of 2 miles. Id. The area at risk is limited by specific design measures in the MLRS launcher and the MLRS rockets that ensure that the rockets fly where they are aimed. Id. ¶¶ 12-13.

The firing points and impact locations used for the MLRS at DPG are such that firings would pose no hazard to the PFSF. Id. ¶¶ 15-22. The MLRS has been fired at DPG only twice in the last 12 years. Id. ¶ 15.[11] While it has been fired from the Wig Mountain area, which is approximately 17 miles west-southwest of the PFSF site, the

---

[8] George Carruth is a former Commander of DPG, and Chief of the Chemical and Nuclear Biological and Chemical Defense Division for the U.S. Army. After his retirement from the Army, he served as Project Manager for a DOE contractor responsible for, among other things, development of requirements for dry storage of spent nuclear fuel. Carruth Dec. ¶¶ 1-2, Exh. 1.

[9] General Matthews could recall only one incident in his 20 some years of experience with the Utah National Guard and as Military Advisor to the Governor where conventional munitions landed outside of Dugway. This was to the South, near Simpson Buttes, roughly 25 miles from the PFSF. Matthews Dep. at 15-16; Carruth Dec. Exh. 2.

[10] See Toledo Edison Company (Davis-Besse Nuclear Power Station, Units 2 and 3), LBP-75-75, 2 NRC 993, 1021-22 (1975), vacated on other grounds, ALAB-622, 12 NRC 667 (1980) (considering orientation and range of weapons in determining that military weapons firing posed no significant hazard); Pacific Gas and Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2), LBP-79-26, 10 NRC 453, 461 (1979).

[11] Moreover, both firings used only training rockets, which do not have warheads, and it is Army policy to issue only training rockets for training use in peacetime. Carruth Dec. ¶ 11 & n.2.

rockets were fired directly away from the PFSF site into the Causeway impact area, which is located 37 miles southwest of the site. Id. ¶ 16. The area at risk extends only a very short distance behind the MLRS launcher, so such firing would in no way threaten the PFSF. Id. ¶ 17. Similarly, other firings or potential firings would pose no hazard in that they would be oriented away from the PFSF or would be entirely out of range of the PFSF. Id. ¶¶ 18-22. Therefore, PFS is entitled to summary disposition with respect to the use of MLRS on Dugway.

C. Cruise Missile Testing Hazards to the PFSF

PFS has specified the facts material to determining the threat to the PFSF posed by the hazards of cruise missile testing which clearly show that cruise missile testing on the UTTR poses no hazard to the PFSF. St. Mat. Facts. Cruise missile launches are generally confined to the northern and western portions of the UTTR and are at least 30 statute miles away from the PFSF site. Aircraft approaches to the points where missiles are launched are normally made from north to south or east to west and are thus directed away from the PFSF site. Cruise missile targets on the UTTR are located over 18 miles from the PFSF.[12] The Air Force plans to perform approximately six cruise missile tests per year on the UTTR. Wagner/Girman Dec. ¶ 26.

Cruise missile tests are carefully planned to ensure their safety. The Air Force applies rigorous test planning, test safety review, and test preparation processes to cruise

[12] Declaration of George Wagner and David Girman (Dec. 30, 2000) ("Wagner/Girman Dec.") ¶ 21. R. Adm. George Wagner, USN (Ret.) was Program Executive Officer for the military Cruise Missile programs and Joint Unmanned Aerial Vehicle programs and was Program Manager for the Ship Launched Tomahawk cruise missile. Lt. Col. David Girman, USAFR, was Flight Commander and Chief of Mission Development for the Tri-Service Standoff Attack Missile and was Deputy Director of Advanced Cruise Missile Operational Test and Evaluation.

missile tests. Id. ¶¶ 8-14. The Air Force uses a minimum separation distance of 2 nautical miles ("nm") between missile flight paths and inhabited areas on the UTTR. The Air Force recognizes 17 such areas in Skull Valley itself. Furthermore, because of the presence of inhabited areas, Army laboratories, Michael AAF, and artillery training ranges on Dugway, the Air Force does not fly cruise missiles over the eastern portion of Dugway. Id. ¶ 22. Because of the flight restrictions in Skull Valley and on Dugway, the performance characteristics of the missiles, and the location of UTTR cruise missile targets, the Air Force does not plot cruise missile flight paths to pass within 10 nm of the PFSF site. Id. ¶ 23. The closest point to the PFSF site at which a cruise missile has crashed is 18 miles away; other UTTR crash sites are even farther away. Id. ¶ 25.

Cruise missiles and other weapon systems that have a capability of exceeding range boundaries are also required to have a Flight Termination System (FTS) installed prior to testing on the UTTR. Id. ¶ 15. The FTSs are designed to promptly destruct the weapons by terminating the weapons' flight paths in the event of an anomaly, either on command by a human or automatically in the event the missile loses communication with the test range or the aircraft supporting the missile test. Id. ¶ 17. The FTS is designed to bring the missile to the ground well within the 2 nm separation distance between missile flight paths and inhabited areas. Id. ¶ 18. The UTTR and the Air Force 49th Test Squadron, which is responsible for all Air Force cruise missile testing, are aware of no instance in which an FTS has failed. Id. ¶ 16. The UTTR and the 49th Test Squadron are aware of no instance in which a cruise missile impacted the ground more than one mile from its planned flight path. Id. ¶ 19. Missiles are carefully tracked while in flight on the UTTR and the FTS may be activated at any time by range safety officers. Id. ¶ 20. Therefore, considering the distance between planned missile flight paths and the PFSF site, in the

event of an anomaly during a cruise missile test, the FTS would bring the missile to the ground far short of the facility.

Consequently, because of the careful safety review that precedes missile tests, the distance between planned missile flight paths and the PFSF site, the presence of the FTS, and the small number of tests annually conducted on the UTTR, a cruise missile striking the PFSF is not a credible event. The NRC Staff has concurred with PFS, for the same reasons, that "there is reasonable assurance that cruise missile testing would not pose a hazard to the [PFSF]." SER at 15–101. In addition, State witness Lt. Col. Hugh Horstman stated in his deposition that he had reviewed the Staff's assessment on cruise missiles and did not take issue with anything in the assessment. Horstman Dep. at 224-25. Moreover, he concurred that cruise missiles routes of flight avoid Skull Valley. Id. at 228. Therefore, for the foregoing reasons, PFS is entitled to summary disposition of Contention Utah K with respect to cruise missiles.

D. Aircraft Accident Hazards to the PFSF

PFS has specified the facts material to determining the threat to the PFSF posed by the hazards of potential aircraft accidents. St. Mat. Facts. PFS has comprehensively assessed the hazard to the PFSF posed by potential aircraft accidents and has shown that the cumulative probability that an accident would cause a release of radioactive material from the PFSF is significantly less than 1E-6[13]/year.[14] This probability is low enough that

[13] 1×10^{-6} or 1/1,000,000.

[14] Private Fuel Storage, Aircraft Crash Impact Hazard at the Private Fuel Storage Facility, Revision 4 (August 10, 2000) (hereinafter "Aircraft Report"), submitted with Declaration of James Cole, Jr., Wayne O. Jefferson, Jr., and Ronald E. Fly (Dec. 30, 2000) (hereinafter "Aircraft Dec."). Brig. Gen. James L. Cole, Jr., USAF (Ret.) was Chief of Safety for the U.S. Air Force and a former wing commander. Maj. Gen. Wayne O. Jefferson, USAF (Ret.) was a former B-52 wing commander. Col. Ronald E. Fly, USAF (Ret.) was an F-16 pilot and commander of the 388th Fighter Wing at Hill Air Force Base.

such accidents are not credible and hence the PFSF need not be designed to withstand their effects. See Section II.B.1, infra. In the SER, the NRC Staff has concurred that the probability of such an accident is less than 1E-6/year and that therefore, from the standpoint of potential aircraft accidents, the PFSF site is acceptable. SER at 15-79 to -81.

1. Regulatory Standard for Aircraft Crash Hazards

Based on the Commission's issuance of credible design basis event standards for facilities performing waste storage and handling at a geologic repository, the regulatory limit for determining credible design basis events for ISFSIs, such as the PFSF, is 1E-6 per year. The Commission recently amended its 10 C.F.R. Part 60 rules for geologic repository operations areas—including surface operations and storage—to establish a probability bound for Category 2 design basis events of 1E-6 per year.[15] "[E]vents with probabilities of occurrence lower than 1×10^{-6} per year could be screened from further consideration due to their negligible contribution to individual risk." 61 Fed. Reg. at 64,261. The Commission intended to make the design basis for Part 60 repositories comparable to that for Part 72 facilities (ISFSIs) "[b]ecause operations at the repository are expected to be similar to operations at . . ." Part 72 facilities. Id. at 64,262. The rulemaking on Part 60 design basis events "harmonize[d] part 60 with part 72" because "part 72 applies to those facilities (MRS installations) most similar to the surface facilities of a repository and for which the kinds of design basis events are also expected to be similar." Id. at 64,265. Further, the Commission expressly confirmed that Part 60 Category 2 events

[15] Disposal of High-Level Radioactive Wastes in Geologic Repositories; Design Basis Events, Final Rule, 61 Fed. Reg. 64,257 (Dec. 4, 1996). Category 2 design basis events are "[o]ther natural and man-induced events that are considered unlikely but sufficiently credible to warrant consideration, taking into account the potential for significant radiological impacts on public health and safety." 10 C.F.R. § 60.2.

were equivalent to "design basis accident[s]" under 10 C.F.R. § 72.106 and that the difference in terminology between Part 60 and Part 72 "is not intended to be one of substance." Id.

Thus, it is appropriate to apply the same probability bound to exclude from design basis accidents under 10 C.F.R. § 72.106 (the applicable standard for ISFSIs) accident events less probable than 1E-6 per year. In fact, such a standard is conservative when applied to the PFSF in that the risks associated with the PFSF will be less than those associated with the above ground facilities at a repository because no fuel processing or repackaging will take place at the PFSF.

Further, in promulgating the standard for Part 60 repositories (and Part 72 ISFSIs), the Commission specifically distinguished the risks of such facilities from the risks associated with operating nuclear reactors. The Commission found that the "conditions are not present at a repository to generate a radioactive source term of a magnitude that, however unlikely, is potentially capable at a nuclear power plant (e.g., from a postulated loss of coolant event)." 61 Fed. Reg. at 64,266.[16] The same holds true for a Part 72 ISFSI, such as the PFSF, at which the primary activities are waste receipt, handling and storage. Because of the significantly lower potential consequences from an accident, it was appropriate to apply a higher probability screening standard to fuel storage and handling facilities than to reactors.[17] The NRC Staff has concurred, for the same reasons, that 1E-6/year is the appropriate accident standard to apply to the PFSF. SER at 15-77.

[16] See also Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), CLI-00-13, 52 NRC 23, 31 & n.1 (2000).

[17] The Standard Review Plan for nuclear power reactors, NUREG-0800, uses an "NRC staff objective of approximately 10^{-7} [1E-7] per year" for determining design basis events for which such reactors should be designed. Because the NUREG-0800 guidance was established for operating nuclear power plants – which

2. Aviation Activity in the Vicinity of the PFSF in Skull Valley

The PFSF site is located in Skull Valley, Utah, approximately 50 miles southwest of Salt Lake City. Aviation activity in the vicinity of the site consists of military operations associated with the UTTR and civilian commercial and potentially general aviation. The UTTR is an Air Force training and testing range. See LBP-99-35, 50 NRC at 195. The airspace over the UTTR extends somewhat beyond the range's land boundaries and is divided into restricted areas, over which the airspace is restricted to military operations, and military operating areas (MOAs). The MOAs on the UTTR are located on the edges of the range, adjacent to the restricted areas. The area covered by the airspace of the UTTR South Area is roughly 148 miles long (at its longest point) by 102 miles wide (at its widest point). The PFSF site is located over 18 statute miles east of the eastern land boundary of the UTTR South Area and 8.5 statute miles northeast of the northeastern boundary of Dugway Proving Ground. The site lies within the Sevier B MOA, two statute miles to the east of the edge of restricted airspace. The area covered by the airspace of the Sevier B MOA is roughly 145 miles long and, in the vicinity of the PFSF site, is roughly 12 miles wide.[18]

---

the Commission specifically distinguished in establishing the probability bound of 1E-6 per year for Part 60 repositories (and Part 72 ISFSI facilities) – the 1E-6 per year probability bound, and not the NUREG guidance of 1E-7 per year, is applicable to the PFSF. Nevertheless, NUREG-0800 goes on to state that "because of the low probabilities of the events under consideration, data are often not available to permit accurate calculation of probabilities. Accordingly, the expected rate of occurrence of potential exposures in excess of the 10 CFR Part 100 guidelines of approximately 10^{-6} per year is acceptable if, when combined with reasonable qualitative arguments, the realistic probability can be shown to be lower." NUREG-0800 at 2.2.3-2 (emphasis added). As discussed infra, the aircraft crash impact hazard calculated by PFS is conservative and the true hazard is significantly lower, realistically less than 1E-7. Therefore, PFS meets the NUREG-0800 guidance as well even assuming that guidance were applicable here.

[18] Aircraft Dec. ¶¶ 13-14.

Military air operations in the vicinity of Skull Valley consist of the following:

- U.S. Air Force F-16 fighter aircraft transiting Skull Valley en route from Hill AFB to the UTTR South Area. Some F-16 flights carry military ordnance.
- F-16s from Hill and other military aircraft of various types conducting training exercises on the UTTR.
- F-16s from Hill occasionally returning from the UTTR South Area to Hill via the Moser Recovery Route, which runs to the northeast, 2-3 miles north of the PFSF site.
- Military aircraft, comprising mostly large transport aircraft, flying on military airway IR-420, to and from Michael Army Airfield, located on DPG, about 17 miles southwest of the PFSF.

Civilian aircraft flying in the vicinity of Skull Valley consist of the following:

- Aircraft flying on Federal airway J-56, which runs east-northeast and west-southwest about 12 miles north of the PFSF site.[19]
- Aircraft flying on airway V-257, which runs north and south about 20 miles east of the site.
- General aviation activity, which has not been reported but conceivably may occur in the area.

Aircraft Dec. ¶¶ 15-16.

PFS has grouped the aircraft flying in and around Skull Valley that could potentially pose a hazard to the PFSF in the event of an accident as above. PFS has calculated the annual crash impact probabilities for the PFSF for each group of aircraft and the probability that ordnance carried on a military aircraft (separate from the aircraft itself)

[19] Commercial air traffic to and from Salt Lake City International Airport, including business jets, flying through the region around the PFSF is included in the traffic on J-56 and V-257.

would impact the PFSF and has shown that the probability is less than 1 E-6/year. Id. ¶ 17.

3. F-16 Aircraft Transiting Skull Valley

F-16 fighter aircraft fly north to south down Skull Valley, within Sevier B MOA, en route from Hill AFB to the UTTR South Area. The F-16s use the eastern side of Skull Valley as their predominant route of travel and typically pass approximately five miles to the east of the PFSF site. The U.S. Air Force has indicated that the F-16s typically fly between 3,000 and 4,000 ft. above ground level (AGL), with a minimum altitude of 1,000 ft. AGL. In Fiscal Year 1998, 3,871 such flights passed through Skull Valley. Aircraft Dec. ¶ 18. On the basis of recent sortie and aircraft basing data from Hill AFB which reflected an increase in activity, PFS estimates that approximately 5,870 F-16 sorties would transit Skull Valley per year. Id. ¶¶ 24-28.[20]

It is not credible that a crashing F-16 would impact the PFSF. The predominant route of travel for the F-16s is down the eastern side of Skull Valley, away from the PFSF. The nature of F-16 flight in Skull Valley is administrative and routine, i.e., low risk. By far the most likely cause of an accident in Skull Valley would be an engine failure, which would leave the pilot in control of the aircraft. Air Force pilots are instructed

[20] The effect of the increase in sorties is to increase the calculated hazard to the PFSF from crashes involving F-16s transiting Skull Valley, falling ordnance jettisoned from those aircraft, crashes involving aircraft operating on the UTTR, and crashes involving aircraft using the Moser recovery. See Aircraft Dec. ¶¶ 28, 33, 43, 47. Because those hazards are directly proportional to the number of relevant aircraft flights, the effect of the new sortie and basing data is to increase those hazards by a factor of 1.516 (5,870/3,871) above what was calculated for them in PFS's Aircraft Report. See id. The State had asserted that PFS had failed to account for the additional aircraft assigned to Hill AFB. State of Utah's Supplemental Response to Applicant's First Set of Discovery Requests for Contention Utah K (Dec. 5, 2000) at 4 ("State Disc. Resp."). PFS's use of more recent sortie and aircraft basing data from Hill directly addresses the State's concerns. Aircraft Dec. ¶ 60.

to avoid ground facilities in the event of a mishap in which the pilot retains control of the direction of the aircraft. Id. ¶ 19.

Nevertheless, using a modification of the method set forth in NUREG-0800,[21] PFS calculated the probability that a transiting F-16 would impact the PFSF and conservatively assuming that the F-16 flights are uniformly distributed across the Sevier B MOA airspace in the vicinity of the PFSF. PFS calculated the probability of impact based on the number of F-16s that annually transit Skull Valley, the effective area of the PFSF from the perspective of a crashing F-16, the width of Skull Valley in the vicinity of the PFSF (i.e., where the F-16 are assumed to fly), and the crash rate per mile for the F-16 under the conditions in which they transit Skull Valley. PFS also accounted for the likely nature of the accidents that could occur in Skull Valley. Specifically, PFS accounted for the fact that it is most likely that an accident in Skull Valley would leave the pilot in control of the aircraft before it impacted the ground, such that the pilot would have the opportunity to direct the aircraft away from a structure on the ground, like the PFSF, before ejecting from the aircraft. Thus, PFS calculated a probability of 3.11 E-7 per year that an F-16 transiting Skull Valley would crash and impact the PFSF. Aircraft Dec. ¶¶ 20-24, 28. The NRC Staff followed an approach very similar to PFS's and the probability that an F-16 transiting Skull Valley would impact the PFSF, although without the benefit of the sortie and basing data PFS recently received from Hill AFB. See SER at 15-49 to – 57. If the most recent data were used in the Staff's model, the result would be very

[21] Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (June 1987) § 3.5.1.6.

. If the most recent data were used in the Staff's model, the result would be very similar to that obtained by PFS. Compare id. with Aircraft Report at 6-25.[22]

PFS also calculated the probability that ordnance jettisoned from a crashing F-16 in Skull Valley would impact the PFSF.[23] Some of the F-16 flights through Skull Valley carry ordnance (live or inert). In the event of an incident leading to a crash in which the pilot would have time to respond before ejecting from the aircraft (e.g., an engine failure), one of the pilot's initial actions would be to jettison any ordnance carried by the aircraft. PFS used an approach similar to the approach it took to calculating the aircraft impact probability to calculate the probability that jettisoned ordnance would impact the PFSF. PFS's calculation accounted for the fraction of the F-16s transiting Skull Valley per year that would be carrying ordnance that could be jettisoned, the fraction of the crashes that would be attributable to engine failure or some other event leaving him in control of the aircraft[24], and the area of the PFSF, from the perspective of a piece of ordnance jettisoned from an aircraft flying from north to south over the site.[25] PFS calculated that the prob-

---

[22] Using the 3,871 sortie data from 1998, PFS had calculated a crash hazard from F-16s transiting Skull Valley of 2.05 E-7/yr.. Aircraft Dec. ¶ 24. Using the same data, the Staff accepted PFS's calculation as reasonable but calculated a conservative hazard for itself of 2.7 E-7/yr. SER at 15-57.

[23] The Air Force has stated unequivocally that the UTTR has never experienced an unanticipated release of munitions outside of designated launch/drop/shoot boxes, so falling ordnance other than that jettisoned from aircraft experiencing an in-flight mishap in Skull Valley would pose no hazard to the PFSF. Aircraft Dec. ¶ 29.

[24] In crashes attributable to other causes it was assumed that the pilot would eject quickly and would not jettison ordnance.

[25] The State's witnesses used the same approach as PFS to calculate the hazard from jettisoned ordnance. See Memorandum from Matt Lamb and Marvin Resnikoff to Hugh Horstman (Dec. 5, 2000) Exhibit 9 to Aircraft Dec. (hereinafter "Lamb/Resnikoff Memo") at 8. The differences arise from the different data the State used in its calculation; PFS addresses those differences individually elsewhere.

ability that jettisoned ordnance would impact the site would be 1.49 E-7. Aircraft Dec. ¶¶ 30-33. The NRC Staff concurred with PFS's analysis. SER at 15-68 to -70.[26]

In addition to the potential hazard posed by direct impacts of crashing aircraft and jettisoned ordnance, PFS also calculated the hazard to the PFSF posed by jettisoned live ordnance that might land near the facility and explode on impact, as well as the hazard posed by a potential explosion of live ordnance carried aboard a crashing aircraft that might impact the ground near the PFSF. At the outset, Air Force pilots do not arm the live ordnance they are carrying while transiting Skull Valley near the PFSF. Furthermore, the U.S. Air Force has indicated that the likelihood that unarmed live ordnance would explode when impacting the ground after being jettisoned is "remote" and the Air Force has no records of such incidents in the last 10 years. Thus, it is highly unlikely that jettisoned live ordnance or live ordnance carried aboard a crashing aircraft that did not directly impact the PFSF would damage the facility. Aircraft Dec. ¶ 34.

Nevertheless, to calculate a numerical hazard to the facility, PFS assumed that such ordnance would have a 1 percent chance of exploding and assessed that damage to the PFSF would result if an explosion occurred close enough that the blast overpressure would damage a storage cask or the Canister Transfer Building, without hitting either one. PFS assumed that the ordnance in question was a 2,000 lb. bomb, the largest single piece of ordnance carried by the F-16s that transit Skull Valley. PFS calculated the probability that an F-16 carrying live ordnance would crash and jettison the ordnance so as to

[26] The difference between PFS's calculation and the Staff's calculation arises from PFS's assumption of more F-16 sorties through Skull Valley. Compare Aircraft Report at 79-83 with SER at 15-68 to -70. Like the risk from aircraft crashes, the risk from jettisoned ordnance is directly proportional to the number of flights through the valley. See Aircraft Dec. ¶¶ 30-31, 33.

impact near the PFSF, or crash near the PFSF without jettisoning the ordnance, following the same method it used to calculate the probability that an F-16 would crash and impact the facility. The results of PFS's final calculation showed that the annual probability that a storage cask or the Canister Transfer Building would be damaged by an explosion of live ordnance jettisoned from a crashing aircraft or carried aboard a crashing aircraft that impacted the ground near the PFSF was equal to 2.43 E-10. This is exceedingly low and is insignificant relative to the other aircraft crash and jettisoned ordnance impact hazards calculated for the PFSF.[27] Aircraft Dec. ¶ 35.

4. Aircraft Conducting Training on the UTTR

According to the Air Force, 8,284 sorties were flown over the UTTR South Area in 1998. Those aircraft conducted a variety of activities, including air-to-air combat training, air-to-ground attack training, air-refueling training, and transportation to and from Michael Army Airfield (which is located beneath UTTR airspace). Aircraft Dec. ¶ 36. Hazards posed by aircraft flying to and from Michael Army Airfield on Dugway are addressed below.

a) Potential Aircraft Impacts

Only fighter aircraft conducting air-to-air training represent even a potential hazard to the PFSF, in that aircraft conducting air-to-ground attack training do so over targets that are located more than 20 miles from the PFSF site and aircraft conducting air refuel-

[27] The NRC Staff calculated the probability that jettisoned ordnance or ordnance carried aboard a crashing aircraft would explode close enough to damage a storage cask or the canister transfer building to be 3.9 E-9 per year, using very conservative assumptions. SER at 15-74 to –76. While that value is higher than what PFS has calculated, the difference is immaterial, in that both values are less than 1 percent of the cumulative hazard to the PFSF from ordnance and aircraft crashes.

ing training do so on the far western side of the UTTR, over 50 miles from the site. Aircraft Dec. ¶ 37. Because fighter aircraft conduct their aggressive maneuvering, which is the most likely cause of an accident on the UTTR toward the center of the restricted ranges of the UTTR, at a distance of miles from the PFSF, such aircraft, as a practical matter, do not pose a significant hazard to the facility. Id. ¶¶ 37, 44. Indeed, the State's witness concurs with such an assessment.[28] Nevertheless, for conservatism, PFS calculated a potential upper bound to the hazard posed by such aircraft.

The Air Force indicated 6,360 fighter sorties were flown on the UTTR South Area in 1998 and one-third, or approximately 2,120, involved fighter aircraft conducting air-to-air training. Taking into account the effect of the higher sortie rates flown from Hill AFB in fiscal years 1999 and 2000, PFS calculated the annual probability that such aircraft would crash and impact the PFSF on the basis of the total crash rate per square mile per year calculated for the UTTR, the area of the UTTR from which aircraft could credibly impact the PFSF in the event of a crash, the effective area of the PFSF from the perspective of a crashing aircraft, the footprint area, in which a disabled aircraft could possibly hit the ground in the event of a crash, and the probability that the pilot of a crashing aircraft would be able to take action to avoid hitting the PFSF. The maximum annual air crash impact probability for aircraft conducting air-to-air training on the UTTR South Area was calculated from the sum of impact probabilities of the altitude bands to be 1.11 E-7. Aircraft Dec. ¶¶ 38-43. The NRC Staff followed an approach very similar to PFS's and calculated, using conservative values of input variables, that the probability that an

[28] Horstman Dep. at 218 ("if an airplane has a problem up there [on the UTTR], it's not going to make it to Skull Valley . . . it's going to crash before it gets there, it's that simple.")

aircraft conducting air-to-air combat training on the UTTR would impact the PFSF would be 7.7 E-8. SER at 15-58 to –66.[29]

b) Weapons Use on the UTTR

Military aircraft conduct air-to-ground attack training and weapons testing using air-delivered ordnance on the UTTR South Area. Nevertheless, the use of air-delivered ordnance on the UTTR does not pose a significant hazard to the PFSF. The PFSF site is located 18 statute miles to the east of the easternmost land boundary of the range and over 20 miles from the nearest target for air-delivered ordnance on the UTTR. Weapons use on the UTTR is strictly controlled and the UTTR has never experienced an unanticipated munitions release outside of designated launch/release areas. Aircraft Dec. ¶ 45. The NRC Staff concurred with PFS's assessment that weapons use on the UTTR does not pose a hazard to the PFSF. SER at 15-58 to –59.

5. Aircraft Flying on the Moser Recovery

Most of the F-16s returning to Hill AFB from the UTTR South Area exit the northern edge of the range (away from the PFSF) in coordination with air traffic control. However, some aircraft returning to Hill from the UTTR South Area may use the Moser recovery route during marginal weather conditions or at night under specific wind conditions. The Moser recovery route runs from the southwest to the northeast, approximately two miles from the PFSF site. Based on information on usage obtained from local air traffic controllers, PFS very conservatively calculated the crash impact hazard to the PFSF similarly to the way in which it calculated the hazard from F-16 aircraft transiting

[29] Again, differences in values calculated by PFS and the Staff arose from PFS's use of higher aircraft sortie rates. Compare Aircraft Report at 29-43a with SER at 15-58 to 15-65.

Skull Valley, described above. PFS calculated an annual impact hazard of 2.0 E-8. Aircraft Dec. ¶¶ 46-47. The NRC Staff concurred with PFS's assessment. SER at 15-66 to –68.[30]

6. Aircraft Flying to and from Michael AAF on IR-420

Michael Army Airfield is located on the Dugway Proving Ground, 17 statute miles south-southwest of the PFSF. Military airway IR-420 terminates north of the PFSF site; aircraft using IR-420 and flying to and from Michael AAF pass in proximity to the site. The majority of the aircraft flying to and from Michael AAF are large cargo aircraft such as the C-5, C-17, and C-141. The same method used to calculate the hazard to the PFSF from F-16s transiting Skull Valley was used to estimate the probability of an aircraft impacting the PFSF from IR-420. PFS calculated a crash impact hazard of 3.0 E-9 per year. Takeoff and landing operations at Michael AAF would pose a negligible hazard to the PFSF because the airfield is over 17 miles from the PFSF. Aircraft Dec. ¶¶ 48-49. The NRC Staff concurred with PFS's assessments. SER at 15-47 to –49.[31]

7. Civilian Aircraft on Airways J-56 and V-257 Including Aircraft from Salt Lake City International Airport

Airway J-56 runs west-southwest and east-northeast 11.5 statute miles north of the PFSF. Airway V-257 runs north and south 19.5 statue miles east of the PFSF. Traf-

---

[30] Differences between the Staff's calculation and PFS's arose from PFS's assumption of a higher usage rate for the Moser recovery, to reflect the increase in sorties from Hill AFB. Compare Aircraft Report at 48-49b with SER at 15-66 to –68. Nevertheless, in light of statements given by State of Utah expert witness Lt. Col. Hugh Horstman, USAF (Ret.) at his deposition, both PFS's and the Staff's assumed usage rates for the Moser recovery are very conservative. Aircraft Dec. ¶ 46.

[31] While there are takeoffs and landings at Michael AAF other than those involving aircraft flying in the direction of IR-420 in the vicinity of the PFSF site (e.g., fighter aircraft temporarily based at Michael during military exercises or aircraft from Hill practicing takeoffs and landings), because those aircraft do not fly near the PFSF, they pose no hazard to it. See Horstman Dep. at 186-88.

fic on J-56 and V-257 consists of commercial airliners and private business jets, including the traffic to and from Salt Lake City International Airport. The same method used to calculate the hazard to the PFSF from F-16s transiting Skull Valley was used to estimate the probability of an aircraft impacting the PFSF from this airway. PFS calculated that the total probability that an aircraft flying on J-56 or V-257 would crash and impact the PFSF is therefore 3.1 E-8 per year. Takeoff and landing operations at Salt Lake City airport, which is approximately 50 miles from the PFSF, would pose no hazard to the facility because of the distance to the PFSF and the annual number of operations at the airport. Aircraft Dec. ¶¶ 50-52. The NRC Staff concurred with PFS's assessments. SER at 15-42 to –44.

8. General Aviation

There are no civilian airports within 25 miles of the PFSF; the PFSF is located in a sparsely populated area; and the PFSF is located inside a military operating area (MOA) in which flight by civilian aircraft is restricted while the MOA is being used by the Air Force (and which is avoided by general aviation pilots because of the difficulty of getting clearance through it). Thus, the general aviation traffic over Skull Valley is negligible; in fact F-16 pilots who have flown from Hill AFB through Skull Valley indicate never having seen general aviation traffic there. Therefore, it is highly unlikely that a general aviation aircraft would crash into the PFSF.[32] Aircraft Dec. ¶ 53. Furthermore, because of

[32] In its Aircraft Report, PFS has calculated what it descried as "an overly conservative upper bound estimate" of the crash impact probability for general aviation aircraft using National Transportation Safety Board (NTSB) crash data and the population of general aviation aircraft in the state of Utah and taking into account the fact that the spent fuel storage casks will be able to resist the impact of most general aviation impacts. The crash impact probability was calculated to be 2.36 E-7. Aircraft Dec. ¶¶ 54-55. The NRC Staff concurred that the general aviation impact hazard to the PFSF is negligible. SER at 15-44 to –46.

the light weight and relatively low speed of general aviation aircraft, PFS has calculated that even if such an aircraft were to hit the PFSF, it would not penetrate a spent fuel storage cask. Declaration of Jeffrey R. Johns (Dec. 27, 2000). Therefore, because a general aviation crash would not cause a release of radioactive material from the PFSF, the hazard from general aviation may be set at zero. Id.; AircraftDec. ¶ 56.

9. Cumulative Hazard to the PFSF from Aircraft Accidents

Summing the probabilities that the potential aviation accidents assessed above, including potential impacts of jettisoned ordnance, would cause a release of radioactive material from the PFSF, the cumulative hazard is 6.25 E-7/year, which is below the applicable risk standard. Aircraft Dec. ¶¶ 57-58. Therefore, potential aircraft accidents do not pose an unacceptable hazard to the PFSF. The NRC Staff concurred with PFS's assessment. SER at 15-79.[33]

10. State Allegations that PFS's Assessment Is Deficient

In recent responses to PFS discovery requests, the State has alleged that PFS's aircraft crash hazard assessment is deficient in several respects.[34] First, PFS assertedly used a crash rate that was too low for Skull Valley and UTTR military flight operations. Second, the State claims that PFS incorrectly assumes a random distribution of flights through Skull Valley, in that if the PFSF is built, F-16 pilots will aim at the facility in or-

---

Evaluation of further information described in the Aircraft and Johns declarations allow this number to now be set at zero.

[33] As discussed above, differences between PFS's and the Staff's calculations arise from PFS's use of higher aircraft sortie rates from Hill AFB and the ability to now unequivocally set the general aviation hazard at zero.

[34] State Disc. Resp.; Lamb/Resnikoff Memo; Deposition of Lt. Col. Hugh L. Horstman, USAF (Ret.) (Dec. 11, 2000) ("Horstman Dep.").

der to calibrate their instruments. Third, the State asserts that PFS overestimates a pilot's ability to avoid the PFSF in the event of a mishap leaving the pilot in control of the aircraft. See State Disc. Resp.; Aircraft Dec. ¶ 59.

Notably, however, the State's alternative assessment of the risk posed by aircraft crashes follows closely the format and methodology used by PFS and the NRC Staff. Compare Lamb/Resnikoff Memo with SER § 15.2.1.11; see also Aircraft Dec. ¶¶ 18-58. Additionally, State witness Lt. Col. Horstman has reviewed PFS's assessment and agrees with it outside of the specific issues identified above. Horstman Dep. at 9-10, 66-67 ("Virtually all of the data in [the assessment] from Colonel Fly, et cetera, I agreed with.").[35] PFS addresses the State's specific allegations here and shows that they either lack factual basis or are immaterial to PFS's conclusion that aircraft crashes would not pose a significant hazard to the PFSF.

a) Skull Valley and UTTR Crash Rates

The State claims that PFS's crash rates for the F-16 are wrong, in that the F-16 will begin to exhibit higher crash rates as it gets older and in the future, a new aircraft, such as the F-22, that might replace the F-16 would have a higher crash rate. E.g., Lamb/Resnikoff Memo at 1. On the contrary, PFS's assumption that projected F-16 crash rates may be represented by a 10-year average of F-16 crash rates is sound. Aircraft Dec. ¶ 62. As a general matter, crash rates in the Air Force are decreasing because of better maintenance, parts control, improved inspections, built-in tests, fault reporting, and

[35] See also Horstman Dep. at 68-70 (where Lt. Col. Horstman agreed that outside the list of concerns identified in the State's discovery response (note 30, supra), he had no problem with the assessment contained in PFS's aircraft crash report).

other improvements. Id. ¶ 63. Furthermore, PFS analysis of the crash rates of the F-16A, which was the first model of the F-16 and which is now being phased out of service, shows no increase as the aircraft approaches its end of service. Id. ¶ 66.[36] Even older aircraft that were recently retired showed level or decreasing crash rates at the end of their service lives, except when their flying hours were very low and hence the yearly average crash rate was vulnerable to statistical aberration. Id. ¶ 65.

Regarding the potential introduction of new aircraft at Hill AFB to replace the F-16, there is no evidence that such an aircraft would have a higher crash rate than the F-16. First, new technology and new methods of developing aircraft have been reducing crash rates at the beginning of the service lives of aircraft. Id. ¶¶ 70-71. Specifically regarding the F-22, it is a twin-engine aircraft and hence would be expected to experience even lower crash rates. Id. ¶ 71. Moreover, it is unclear that the F-22 would replace the F-16; indeed, the Air Force has not yet decided to buy the aircraft. Id. ¶ 72. Thus, any argument about the crash rates of future aircraft being higher than those of the F-16 is speculative and unsupported. Thus, there is no need for PFS to change its F-16 crash rates.

b) Distribution of F-16 Flights in Skull Valley

The State next claims that PFS's assessment is flawed because F-16 pilots will assertedly point their aircraft at the PFSF as they transit Skull Valley for the purpose of navigating and calibrating their instruments and thus, PFS should have modeled Skull Valley as an airway narrower than 10 miles. E.g., Lamb/Resnikoff Memo at 1, 4. Thus, the State asserts that the PFSF will essentially be an attractive nuisance.

[36] Indeed, Lt. Col. Horstman suggested that analysis of F-16A crash rates was a way to determine whether F-16 crash rates would increase in the future. Horstman Dep. at 217, 236.

The State's assertion is incorrect for a number of reasons. First, there is no requirement for F-16 pilots to calibrate their instruments at the PFSF site and they do not do so now. Aircraft Dec. ¶¶ 77, 79. Because of the many visible features in Skull Valley, there is no need for pilots to use the PFSF as a navigational reference point and it is not likely that they would as a matter of preference. Id. ¶¶ 76, 81. Pilots now perform a number of other functions with their aircraft while transiting Skull Valley. Building the PFSF would not free them from the need to perform those functions nor would it make it advantageous to perform those functions elsewhere. Id. ¶¶ 75, 80. Furthermore, because of restricted airspace constraints and the function of the F-16s instruments, flying directly at or over the PFSF would not be an optimal route for calibrating the instruments. Id. ¶¶ 74, 79, 81. In addition, even if a pilot wished to calibrate his instruments in Skull Valley, there are locations other than the PFSF site that would be suitable for doing so. Id. ¶¶ 76, 81.

In addition, while PFS does not believe that any sort of overflight restriction for the PFSF is required or desirable, because of the low risk of an accident, the State has previously claimed that Air Force pilots would avoid the PFSF regardless of risk, in order to avoid potential liability for an accident. State of Utah's Request for Admission of Late-Filed Utah Contention KK (July 27, 2000) at 7. The State's contention was supported by Maj. Gen. Michael Pavich, USAF (Ret.).[37] The State's claim now, that pilots would deliberately fly at the site, is directly contradicted by its and its witness' prior as-

[37] Declaration of Michael D. Pavich in Support of State of Utah's Request for Admission of Late-Filed Bases for Utah Contention KK (July 27, 2000). Gen. Pavich has claimed that "the Air Force would not allow its planes to fly anywhere near the nuclear waste facility for fear that a plane, part of a plane, missile or other military apparatus could fall from the air and cause damage to the nuclear storage facility." Zack Van Eyck, Test range is new weapon in dog fight against N-site, Deseret News, September 5, 2000, at A1.

sertions. Indeed, at the end of his deposition, even Lt. Col. Horstman was ambiguous about exactly where the pilots would go, stating that they would fly toward the site and turn away anywhere from directly overtop the site to 10 miles away. Horstman Dep. at 229-30. Therefore, it should not be assumed that F-16 pilots would change their current behavior and fly at or over the PFSF site such that the risk to the facility from aircraft crashes would increase beyond what PFS has calculated.

Finally, the State's assumption, that pilots would regularly fly at the PFSF and will use it as a point on which to update their sensors, would alter other basic assumptions under the Aircraft Report Methodology and make PFS's crash impact more conservative. The State is essentially claiming that all pilots will use the PFSF regularly as a primary visual reference point; thus, they would be well aware of its exact location when transiting Skull Valley. This would make it even more unlikely that a pilot would fail to avoid the PFSF if his aircraft suffered a mishap that left him in control of it. Since PFS has assumed that some of those pilots would not avoid the PFSF, the State's assumption would in fact make PFS's crash impact calculation more conservative. Aircraft Dec. ¶¶ 83-84.

c) Avoidance of the PFSF in the Event of a Mishap

The State claims that PFS's assessment is flawed because PFS overestimates the likelihood that a pilot would avoid the site in the event of a mishap that left him in control of his aircraft. E.g., State Disc. Resp. at 5; Lamb/Resnikoff Memo at 1. Specifically, the State claims (1) that PFS does not account for variations in pilot experience, State Disc. Resp. at 5, and (2) that bad weather will obscure the PFSF and prevent a pilot from avoiding the site, Lamb/Resnikoff Memo at 1. Both claims lack any substantive factual basis.

First, while Lt. Col. Horstman stated that he felt that PFS's assumption that pilots would be able to avoid the PFSF in 95 percent of the mishaps that left them in control of their aircraft was too high because it did not account for potential pilot inexperience, he repeatedly said he did not know what the correct avoidance fraction should be. Horstman Dep. at 173, 175-77, 181, 185. The Board has rejected similar speculative claims before and it should reject this one as well. See LBP-99-35, 50 NRC at 193-94. Furthermore, Lt. Col. Horstman erroneously attempts to tie a pilot's hypothetical "inexperience" (implying lack of skill) to an Air Force management definition of "inexperienced" pilot that reflects the number of hours a pilot has in an aircraft but does not describe his skill in flying the aircraft and hence avoiding the PFSF site in the event of a mishap. Aircraft Dec. ¶¶ 87-91. In fact, even junior Air Force pilots are highly trained and would be able to avoid the PFSF in the event of an inflight mishap that left them in control of the aircraft. PFS reviewed all of the available F-16 mishap reports for the last 10 years and found no instance in which a pilot with control and available time failed to direct his crashing aircraft so as to minimize damage to areas on the ground. Id. ¶ 92. Thus, the mishap reports of actual accidents show that contrary to Lt. Col. Horstman's speculative claim, PFS's use of a 95° avoidance rate is conservative. The mishap reports show that the avoidance factor could essentially be set at 100%.

Finally, PFS's assessment was conservative with respect to its estimate of the proportion of accidents in which a pilot in Skull Valley would retain control of his aircraft in the first place and hence be able to avoid the site. Thus, the assessment actually underestimates a pilot's ability to avoid the PFSF site in the event of a mishap. Id. ¶ 93. In short, there is no basis for the State's claim that PFS needs to change its assessment to account for pilot inexperience.

Second, the State's claim that weather would obscure the PFSF a significant fraction of the time and prevent a pilot from avoiding the site, Lamb/Resnikoff Memo at 1, 3-4, is also wrong. First, the State's claim is simply based on an erroneous assumption that 50 percent cloud cover in the sky would render the PFSF invisible. Aircraft Dec. ¶¶ 97-97. The weather in the UTTR is very good, with at least a 3,000 ft. cloud ceiling and 3 miles visibility 96 percent of the time and 10 miles visibility 95 percent of the time. Since a pilot could fly through Skull Valley under a 3,000 ft. ceiling and keep the PFSF in sight, weather would not impede his ability to avoid the site in the event of an in-flight mishap. Id. ¶ 104. Furthermore, on some of the days on which the UTTR had a ceiling under 3,000 ft. or less than 3 miles visibility, the F-16s would not fly at all. Id. ¶ 110. In addition, the UTTR exhibits cloud ceilings of at least 6,000 ft. (which would include all of the airspace of Sevier B MOA in Skull Valley) roughly 320 days per year: such weather would allow pilots to fly through Skull Valley as they normally do without obscuring the PFSF. Id. ¶ 105. Finally, F-16 mishap reports describing accidents that occurred in bad weather contain a number of references to pilots avoiding populated areas on the ground despite being in clouds or above clouds and unable to see the ground. Id. ¶¶ 112-13. In Skull Valley, even if a pilot did not see the PFSF at the exact time of the in-flight mishap, he would likely be aware of its location from other visual references and his aircraft instruments. Id. ¶¶ 108-09. Therefore, weather would not realistically prevent a pilot from avoiding the PFSF in the event of a mishap and PFS need not change its aircraft crash hazard assessment.

11. Conservatism Remaining In PFS's Assessment

Even if the State's challenges had some merit, PFS's assessment is conservative in a number of ways that ultimately render the State's claims immaterial:

- PFS's F-16 crash rates are based on Class A and B mishap rates rather than destroyed aircraft rates. Aircraft Dec. ¶ 118.

- PFS assumed that any F-16 impacting the site would cause a release of radioactive material, when an F-16 that impacted the site after a mishap leaving the pilot in control of the aircraft would not. Id. ¶ 119.

- PFS assumed that aircraft operating on the UTTR could potentially impact the PFSF site when, realistically, they are too far away to do so. Id. ¶ 120.

- PFS's calculation of the hazard from jettisoned ordnance does not account for the fact that much of the PFSF cask storage area consists of open space where impacting ordnance would do no harm and it does not account for the fact that the inert ordnance carried by F-16s would not penetrate the top of a storage cask if it hit it. Id. ¶ 121.

- PFS assumes that the PFSF is at a full capacity at all times, when in fact the average area of the site over its lifetime will be equal to only 55 percent of the area at full capacity. Id. ¶ 122.

Therefore, and for the reasons discussed above, PFS is entitled to summary disposition with respect to the hazard posed to the PFSF by aircraft crashes.

III. CONCLUSION

The use of weapons on Dugway Proving Ground, cruise missile testing on the UTTR, and potential aircraft accidents would not pose credible hazards to the PFSF. Therefore, PFS is entitled to summary disposition of Contention Utah K.

Respectfully submitted,

Jay E. Silberg
Ernest L. Blake, Jr.
Paul A. Gaukler
D. Sean Barnett
SHAW PITTMAN
2300 N Street, N.W.
Washington, DC 20037
(202) 663-8000
Counsel for Private Fuel Storage L.L.C.

Dated: December 30, 2000

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

CERTIFICATE OF SERVICE

I hereby certify that copies of Applicant's Motion for Partial Summary Disposition Of Utah Contention K and Confederated Tribes Contention B With Respect to the Aircraft Accident and Cruise Missile Hazards, were served on the persons listed below (unless otherwise noted) by e-mail with conforming copies by U.S. mail, first class, postage prepaid, this 30th day of December 2000.

G. Paul Bollwerk III, Esq., Chairman Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: GPB@nrc.gov

Dr. Jerry R. Kline
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: JRK2@nrc.gov; kjerry@erols.com

Dr. Peter S. Lam
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: PSL@nrc.gov

* Susan F. Shankman
Deputy Director, Licensing & Inspection Directorate, Spent Fuel Project Office
Office of Nuclear Material Safety & Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Rulemakings and Adjudications Staff
e-mail: hearingdocket@nrc.gov
(Original and two copies)

* Adjudicatory File
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Catherine L. Marco, Esq.
Sherwin E. Turk, Esq.
Office of the General Counsel
Mail Stop O-15 B18
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
e-mail: pfscase@nrc.gov

Denise Chancellor, Esq.
Assistant Attorney General
Utah Attorney General's Office
160 East 300 South, 5th Floor
P.O. Box 140873
Salt Lake City, Utah 84114-0873
e-mail: dchancel@state.UT.US

John Paul Kennedy, Sr., Esq.
Confederated Tribes of the Goshute Reservation and David Pete
1385 Yale Avenue
Salt Lake City, Utah 84105
e-mail: john@kennedys.org

Joro Walker, Esq.
Land and Water Fund of the Rockies
2056 East 3300 South, Suite 1
Salt Lake City, UT 84109
e-mail: joro61@inconnect.com

Diane Curran, Esq.
Harmon, Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
e-mail: DCurran.HCSE@zzapp.org

Danny Quintana, Esq.
Skull Valley Band of Goshute Indians
Danny Quintana & Associates, P.C.
68 South Main Street, Suite 600
Salt Lake City, Utah 84101
e-mail: quintana@xmission.com

Richard E. Condit, Esq.
Land and Water Fund of the Rockies
2260 Baseline Road, Suite 200
Boulder, CO 80302

* By U.S. mail only

D. Sean Barnett

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	

STATEMENT OF MATERIAL FACTS

The Applicant submits, in support of its motion for summary disposition of Utah K, this statement of material facts as to which the Applicant contends that there is no genuine issue to be heard.

A. The Use of MLRS on Dugway Proving Ground

1. The northern boundary of Dugway Proving Ground is located over 8 miles south and southwest of the PFSF site. Carruth Dec. ¶ 4.

2. The use of military ordnance at DPG will not pose a hazard to the PFSF because: 1) the firing of weapons is covered by stringent safety procedures, 2) the closest firing position to the PFSF is more than 15 miles away, 3) weapons used on Dugway, other than the MLRS, are out of range of the PFSF site, and 4) weapons, including the MLRS, are fired in directions away from the PFSF. Id. ¶¶ 4-8.

3. The MLRS has a maximum range of 20 miles and the area at risk from the firing of rockets extends a maximum of only 2 miles to either side of the line on which the rockets are fired. Carruth Dec. ¶ 10. The MLRS launcher and the MLRS rockets possess specific design measures to ensure that the rockets do not deviate significantly from their intended flight paths. Id. ¶¶ 12-13.

4. The potential impact areas for MLRS rockets on Dugway are the Causeway Impact Area, which is 37 miles from the PFSF site, id. ¶ 17; the Wig Mountain Impact Area, which is 20 miles from the PFSF site, id. ¶ 19; and the White Sage Impact Area, which is over 19 miles from the PFSF site, id. ¶ 22.

5. MLRS firings from the Wig Mountain area, which is the firing point closest to the PFSF, at a distance of 17 miles, would pose no hazard to the PFSF because the potential impact areas for the rockets are all located in directions from Wig Mountain away from the PFSF. Id. ¶ 17; see id. ¶¶ 18-22.

6. MLRS firings from other locations into the potential impact areas at DPG would pose no hazard to the PFSF because the rockets would have to be fired in directions away from the PFSF or the launcher would be entirely out of range of the PFSF. Id. ¶¶ 17-22.

7. The MLRS has been fired on Dugway only twice in the past 12 years. Id. ¶ 15. Both firings used only training rockets that do not possess explosive warheads. Id. ¶¶ 11, 16, 19. It is Army policy to issue only training rockets for training during peacetime. Id. ¶ 11 n.2.

B. Cruise Missile Testing on the UTTR

1. The PFSF site is located over 18 statute miles east of the eastern land boundary of the South Area of the UTTR and 8.5 statute miles northeast of the northeastern boundary of Dugway Proving Ground. Wagner/Girman Dec. ¶ 6.

2. Three types of cruise missiles have been tested on the UTTR: Air Launched Cruise Missile (ALCM), Tomahawk, and Advanced Cruise Missile (ACM). All three are subsonic (450-500 knots airspeed), autonomous missiles, which fly carefully pre-programmed flights along designated routes. Nominal cruise missile altitudes in flight are usually below 10,000 feet down to 500 feet AGL. Id. ¶ 7.

3. The Air Force plans to conduct six cruise missile tests per year on the UTTR. Id. ¶ 26.

4. Cruise missile tests are carefully planned to ensure their safety. The Air Force applies rigorous test planning, test safety review, and test preparation processes to cruise missile tests. Id. ¶¶ 8-14.

5. The Air Force uses a minimum separation distance of 2 nm between missile flight paths and inhabited areas on the UTTR. Id. ¶ 22.

6. Because of the flight restrictions around inhabited areas in Skull Valley and on Dugway, the performance characteristics of the missiles, and the location of UTTR cruise missile targets, the Air Force does not plot cruise missile flight paths to pass within 10 nm of the PFSF site. Id. ¶ 23.

7. The cruise missile crash impact location closest to the PFSF site is 18 miles away. Id. ¶ 25.

8. Cruise missiles and other weapon systems that have a capability of exceeding range boundaries are also required to have a Flight Termination System (FTS) installed prior to testing on the UTTR. Id. ¶ 15.

9. FTSs are designed to promptly destruct the weapons by terminating the weapons' flight paths in the event of an anomaly, either on command by a human or automatically in the event the missile loses communication with the test range or the aircraft supporting the missile test. Id. ¶ 17. The FTS is designed to bring the missile to the ground well within the 2 nm separation distance between missile flight paths and inhabited areas. Id. ¶ 18. The UTTR and the Air Force 49th Test Squadron are aware of no instance in which an FTS has failed. Id. ¶ 16. The UTTR and the 49th Test Squadron are aware of no instance in which a cruise mis-

sile impacted the ground more than one mile from its planned flight path. Id. ¶ 19.

10. Missiles are carefully tracked while in flight on the UTTR and the FTS may be activated at any time by range safety officers. Id. ¶ 20.

C. The Hazard Posed by Aircraft Crashes

1. The PFSF site is located in Skull Valley, Utah, approximately 50 miles southwest of Salt Lake City. Aircraft Dec. ¶ 13.

2. The PFSF site lies within the Sevier B MOA (which is part of UTTR airspace), two statute miles to the east of the edge of restricted airspace. The area covered by the airspace of the Sevier B MOA is roughly 145 miles long and, in the vicinity of the PFSF site, is roughly 12 miles wide. Id. ¶ 14.

3. Military air operations in the vicinity of Skull Valley consist of the following (Id. ¶ 15):

- F-16 fighter aircraft transiting Skull Valley en route from Hill AFB to the UTTR South Area.
- Military aircraft of various types conducting training exercises on the UTTR.
- F-16s from Hill occasionally returning from the UTTR South Area to Hill via the Moser Recovery Route.
- Military aircraft, comprising mostly large transport aircraft, flying from the direction of military airway IR-420, to and from Michael Army Airfield, located on DPG, about 17 miles southwest of the PFSF.

4. Civilian aircraft flying in the vicinity of Skull Valley consist of the following (Id. ¶ 15):

- Aircraft flying on Federal airway J-56, which runs east-northeast and west-southwest about 12 miles north of the PFSF site.

- Aircraft flying on airway V-257, which runs north and south about 20 miles east of the site.
- Minimal general aviation activity.

1. F-16 Transits of Skull Valley

5. F-16 fighter aircraft fly north to south down Skull Valley, within Sevier B MOA, en route from Hill AFB to the UTTR South Area, typically between 3,000 and 4,000 ft. above ground level (AGL), with a minimum altitude of 1,000 ft AGL. Id. ¶ 18. The predominant route of travel for the F-16s is down the eastern side of Skull Valley, away from the PFSF. Id. ¶ 19.

6. Approximately 5,870 F-16 sorties would transit Skull Valley per year. Id. ¶¶ 24-28.

7. The nature of F-16 flight in Skull Valley is low risk. By far the most likely cause of an accident in Skull Valley would be an engine failure, which would leave the pilot in control of the aircraft. Id. ¶ 19.

8. The Sevier B MOA airspace in the vicinity of the PFSF may be modeled as an airway with a width of 10 statute miles. Id. ¶ 21; see id. ¶¶ 73-86 (responding to State claim that pilots will deliberately fly at the PFSF site and hence reduce the effective size of the airway).

9. The PFSF has an effective area of 0.1337 sq. mi. Id. ¶ 21.

10. The crash rate for F-16s transiting Skull Valley is 2.736 E-8 per mile. Id.; see id. ¶¶ 61-72 (responding to State claims that rate should be higher).

11. Over 90 percent of the F-16 crashes that might occur in Skull Valley would leave the pilot in control of the aircraft with the time to guide the aircraft away from the PFSF before ejecting. Id. ¶ 21.

12. In the event of an in-flight mishap that left the pilot in control of the aircraft, he would be able to direct his aircraft away from the PFSF before ejecting 95 percent of the time. Id. ¶ 22; see id. ¶¶ 87-115 (responding to State claim that pilot inexperience and weather would reduce the probability of avoidance).

13. The probability that an aircraft flying on an airway over a site would crash and impact the site is given by: $P = N \times C \times A/W$, where P is the probability, N is the number of flights per year, C is the crash rate per mile, A is the effective area of the site, and W is the width of the airway. Where it is possible for a pilot to guide the aircraft away from the site on the ground, the probability must be modified to reflect that potential. Id. ¶¶ 20-23.

14. The probability that a crashing F-16 in Skull Valley would impact the PFSF is 3.11 E-7. Id. ¶ 28.

2. Potential Ordnance Impacts

15. The UTTR has never experienced an unanticipated munitions release outside of designated launch/drop/shoot boxes. Consequently the likelihood of an unanticipated munitions release resulting in an impact at the PFSF is zero. Id. ¶ 29.

16. The probability that F-16s transiting Skull Valley would jettison ordnance in response to an in-flight mishap that would impact the PFSF is given by: $P = N \times C \times e \times A/W$, where P, C, A, and W are as defined in Fact 13 above; N is the number of F-16s carrying jettisonable ordnance, and e is the fraction of aircraft crashes caused by events that leave the pilot in control of the aircraft. Id. ¶¶ 30-32.

17. From the perspective of jettisoned ordnance, the effective area of the PFSF, A, is equal to 0.08763 sq. mi. Id. ¶ 32.

18. The fraction of F-16s transiting Skull Valley that carry jettisonable ordnance is equal to 11.8 percent. Id. ¶ 31.

19. The probability that jettisoned ordnance would impact the PFSF is equal to 1.49 E-7. Id. ¶¶ 32-33.

20. The probability that live ordnance carried by F-16s over Skull Valley would explode after being jettisoned and striking the ground is remote. Id. ¶ 34.

21. The hazard to the PFSF from jettisoned ordnance or ordnance carried aboard a crashing aircraft that impacted near the PFSF (but did not strike it) and exploded would be governed by the blast overpressure produced by the explosion relative to the resistance to blast overpressure of the spent fuel storage casks and canister transfer building at the PFSF. Id. ¶ 35.

22. The fraction of F-16s that transit Skull Valley with live ordnance is slightly less than five percent. Aircraft Report at 83h.

23. The probability that exploding ordnance from an F-16 transiting Skull Valley would damage a spent fuel storage cask or the canister transfer building is 2.43 E-10, which is insignificant relative to the other aircraft crash impact hazards to the PFSF. Aircraft Dec. ¶ 35.

3. Aircraft Conducting Training on the UTTR

24. Aircraft conduct a variety of activities on the UTTR, including air-to-air combat training, air-to-ground attack training and air-refueling training. Id. ¶ 36.

25. Only fighter aircraft conducting air-to-air training represent even a potential hazard to the PFSF, in that aircraft conducting air-to-ground attack training do so over targets that are located more than 20 miles from the PFSF site and aircraft conducting air refueling training do so on the far western side of the UTTR, over 50 miles from the site. Id. ¶ 37.

26. Because fighter aircraft performing air-to-air combat training conduct their aggressive maneuvering toward the center of the restricted ranges of the UTTR, at a

distance of miles from the PFSF, such aircraft, as a practical matter, do not pose a significant hazard to the facility. Id. ¶¶ 37, 44.

27. A conservative estimate of the probability that an aircraft from the UTTR would impact the PFSF is given by $P = C_a \times A_c \times A/A_p \times R$, where P = annual crash impact probability, C_a = total air-to-air training crash rate per square mile on the UTTR, A_c = the area of the UTTR from which aircraft could credibly impact the PFSF in the event of a crash, A = effective area of the PFSF in square miles, A_p = the footprint area, in which a disabled aircraft could possibly hit the ground in the event of a crash, and R = the probability that the pilot of a crashing aircraft would be able to take action to avoid hitting the PFSF. Id. ¶ 39.

28. The total number of hours flown per year by fighter aircraft in air-to-air training on the UTTR South Area is estimated to be 3,741. See id. ¶¶ 40, 43 (2,468 hours in 1998 x factor of 1.516 to account for recent aircraft basing and sortie data).

29. The crash rate for F-16s in air-to-air combat training is 3.96 E-5 per hour. Id. ¶ 40.

30. C_a for the UTTR restricted areas nearest the PFSF are 2.52 E-6 (for R6402) and 2.05 E-05 (for R6406). Aircraft Report Table 3 (after p. 32).

31. A_c is conservatively defined as the portion of the UTTR within 10 miles of the PFSF, except for a three-mile buffer zone just inside the outer boundaries of the restricted areas on the range. Aircraft Dec. ¶ 41.

32. *Ap* is equal to the product of a crashing aircraft's altitude and its glide ratio, up to a maximum of 10 miles. UTTR aircraft were divided into altitude bands to account for aircraft potentially experiencing mishaps at different altitudes. Id. ¶ 42.

33. Based on the fraction of accidents on the UTTR that would leave the pilot in control of his aircraft after the in-flight mishap, R is equal to 0.573. Id. ¶ 40.

34. The conservatively calculated probability that an aircraft on the UTTR would crash and impact the PFSF is equal to 1.11 E-7. Id. ¶ 43.

35. Because of the distance from the PFSF at which air-delivered weapons are used on the UTTR, such use would pose no hazard to the facility. Id. ¶ 45.

4. Aircraft on the Moser Recovery

36. Some F-16s returning to Hill AFB from the UTTR South Area may use the Moser recovery route, which runs from the southwest to the northeast, approximately two miles from the PFSF site. Id. ¶ 46.

37. Conservatively estimated, fewer than five percent of the F-16s returning from the UTTR South Area use the Moser recovery. Id. ¶ 46.

38. The hazard to the PFSF from aircraft using the Moser recovery can be calculated using the same methodology used to calculate the hazard from F-16s transiting Skull Valley. Id. ¶ 47.

39. The Moser recovery may be modeled as an airway with a width of 10 nautical miles. Id.

40. The crash impact hazard to the PFSF from flights on the Moser recovery is equal to 2.0 E-8. Id.

5. Aircraft Flying to and from Michael Army Airfield

41. Michael Army Airfield is located on Dugway Proving Ground, 17 statute miles south-southwest of the PFSF. Id. ¶ 48.

42. There are approximately 414 flights annually at Michael AAF that go to or from Michael in the direction of military airway IR-420, in the vicinity of the PFSF site. Id. ¶¶ 48-49. The majority of the aircraft flying to and from Michael AAF are large cargo aircraft such as the C-5, C-17, and C-141. Id. ¶ 48.

43. The hazard to the PFSF from aircraft flying to and from Michael AAF can be calculated using the same methodology used to calculate the hazard from F-16s transiting Skull Valley. Id. ¶ 49.

44. The crash rate for aircraft flying to and from Michael AAF is 4 E-10 per mile. Id.

45. The effective area of the PFSF for large cargo aircraft is 0.2116 sq. mi. Id.

46. The route flown by aircraft to and from Michael AAF toward IR-420 may be modeled as an airway 10 nautical miles wide. Id.

47. The crash impact hazard to the PFSF from flights to and from Michael AAF is equal to 3.0 E-9. Id.

6. Civilian Aircraft Flying on Airways J-56 and V-257 Including Aircraft Flying to and from Salt Lake City International Airport

48. Airway J-56 runs west-southwest and east-northeast 11.5 statute miles north of the PFSF. Id. ¶ 50.

49. Airway V-257 runs north and south 19.5 statue miles east of the PFSF. Id.

50. Traffic on J-56 and V-257 consists of commercial airliners and private business jets, including the traffic to and from Salt Lake City International Airport. Id.

51. The same method used to calculate the hazard to the PFSF from F-16s transiting Skull Valley can be used to estimate the probability of an aircraft impacting the PFSF from both of these airways. Id.

52. The in-flight crash rate for aircraft on J-56 and V-257 is 4 E-10 per mile. Id. ¶ 51.

53. Fewer than 12 aircraft per day transit each airway. Id.

54. The effective area of the PFSF is 0.2116 mi^2, calculated for large commercial airliners. Id.

55. J-56 is eight nautical miles wide. Id.

56. V-257 is 12 nautical miles wide. Id.

57. The total probability that an aircraft flying on J-56 or V-257 would crash and impact the PFSF is 3.1 E-8 per year. Id.

58. Salt Lake City airport is approximately 50 miles from the PFSF. Id. ¶ 52.

59. The risk posed by takeoffs and landings at an airport is negligible if the number of takeoffs and landings is less than 1,000 x D^2, where D is the distance from the airport in miles. Id.

60. There were 365,000 takeoffs and landings at Salt Lake City in 1998. Based on FAA projections, by FY2027, the number of takeoffs and landings at Salt Lake City will be equal to 855,000 per year. Id.

61. The projected number of takeoffs and landings at Salt Lake City are low enough that the hazard to the PFSF from them would be negligible. Id.

7. General Aviation

62. The level of general aviation traffic in Skull Valley is negligible. Id. ¶ 53.

63. The impact at the PFSF of a general aviation aircraft of the types that might be found in Skull Valley would not penetrate a spent fuel storage cask. Id. ¶ 56; Declaration of Jeffrey R. Johns.

64. Because of the negligible traffic level and the fact that an aircraft impact would not penetrate a spent fuel storage cask, the hazard to the PFSF from general aviation impacts is negligible. Aircraft Dec. ¶ 56.

8. Cumulative Hazard to the PFSF from Aircraft Accidents

65. The cumulative probability that an aircraft accident would cause a release of radioactive material from the PFSF is equal to 4.76 E-7. Id. ¶ 58.

66. The probability that jettisoned ordnance would impact the PFSF is equal to 1.49 E-7. Id.

67. The cumulative hazard to the PFSF from aircraft accidents and jettisoned ordnance is equal to 6.25 E-7. Id.

Document #: 1029043 v.1

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	

ATTACHMENTS FOR
APPLICANT'S MOTION FOR SUMMARY DISPOSITION OF
UTAH CONTENTION K AND CONFEDERATED TRIBES CONTENTION B

Tab No.	Subject
A	Declaration of George Carruth
B	Declaration of George Wagner and David Girman
C	Declaration of James L. Cole, Jr., Wayne O. Jefferson, Jr., and Ronald E. Fly
D	Declaration of Jeffrey R. Johns
E	Declaration of Stephen A. Vigeant
F	Deposition of Hugh H. Horstman

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	

DECLARATION OF GEORGE CARRUTH

George A. Carruth states as follows under penalties of perjury:

1. I am currently an independent consultant. I completed a 30-year career in the Army Chemical Corps in June 1987 and retired as System Integration Manager on the Department of Energy Management and Operating Contract for the Civilian Radioactive Waste Management System for TRW, Inc. in 1998. I am providing this declaration in support of a motion for summary disposition of Contention Utah K in the above captioned proceeding to assess the potential hazards posed to the Private Fuel Storage Facility (PFSF) from the use of military weapons and ordnance on Dugway Proving Ground.

2. I am knowledgeable of the activities that will take place at the PFSF on the basis of my review of PFSF documents, discussions with people knowledgeable of the PFSF, and work on the design of similar facilities. My professional and educational experience is summarized in the curriculum vitae attached as Exhibit 1 to this declaration. During my career in the Army Chemical Corps, I commanded Dugway Proving Ground (DPG) from July 1981 until July 1984. After my military career, I was employed by TRW, Inc. for 11 ½ years, retiring December 31, 1998. My last position with TRW was System Integration Manager on the Department of Energy Management and Operating Contract for the Civilian Radioactive Waste Management System. In that position, I was responsible for developing requirements documents for the transportation, storage (in-

cluding dry storage of spent nuclear fuel in casks similar to those to be used at the PFSF), and disposal elements of the waste management system.

3. Contention Utah K, as admitted by the Licensing Board, alleges that the Applicant inadequately considered the potential effect on the PFSF of credible accidents from various nearby facilities. Specifically, Utah K contends in part that the Applicant inadequately considered the hazard to the PFSF from the use of military ordnance on Dugway Proving Ground (DPG). The State of Utah has asserted that such use, particularly the use of the Army Multiple Launch Rocket System (MLRS), poses a hazard to the PFSF.

4. The PFSF will be located over 8 miles north from the northeastern boundary of DPG and will be at least 16 miles from the closest points where ordnance is fired on DPG. I have reviewed the Army's use of ordnance on DPG and its potential hazards and have concluded that because of the distance between the PFSF and the places where ordnance has been and could be used on DPG and the extensive safety precautions that are taken with respect to the use of weapons on DPG, the use of ordnance, including the use of the MLRS, would not pose a credible hazard to the PFSF.

A. Military Ordnance Use on DPG

5. DPG tests conventional and smoke munitions and the DPG ranges are utilized by Army units, including the Utah National Guard, for military training. Weapons fired at DPG include 60 and 81 millimeter mortars; 105 millimeter, 155 millimeter, and 8 inch howitzers; the MLRS rocket system; and some helicopter gun systems. As part of the Army program for the development of battlefield obscurants, DPG may fire obscurant munitions on designated ranges to measure characteristics of the obscurant in the field and to measure the effectiveness of the dispersal from the munition. DPG may also fire other conventional munitions as part of the manufacturing acceptance testing. This firing takes place on ranges to the south of Ditto Technical Center. See Map attached to this declaration as Exhibit 2.

6. The firing of conventional weapons that takes place at DPG would not pose a credible hazard to the PFSF. The firing of weapons is governed by a rigid set of safety regulations. Those regulations prescribe measures to be taken to ensure that there are no individuals in munition impact areas, prescribe controls to be employed regarding the approval of the directions in which weapons are fired, and define procedural checks to ensure that range safety controls are met. Firing is conducted only after approval of the DPG Range Control Office and only from approved weapons, under prescribed controls, on designated, surveyed, firing ranges, to ensure that munitions fired will not fall outside of their designated impact areas. Furthermore, the DPG Range Control Office monitors all range firing to ensure the safety of the operations. See Exhibit 5 attached to this declaration (excerpts from Dugway Proving Ground Regulations, DPGR 350-2 (January 7, 1999)).

7. All artillery projectiles fired at Dugway must be aimed to fall within established impact areas. Exhibit 5 at 8-2. Also, surface danger areas for weapons (i.e., areas which encompass the effects of weapons use) are not permitted to cross or intersect Dugway boundaries. Id. at 4-1 to 4-2. Dugway regulations require personnel firing weapons to be certified for safety and they strictly control weapon firing points, firing directions, intervening activities, and impact areas to ensure that firing is safe. Id. Chapters 1, 6, 8. See Exhibit 5.

8. Specifically, in addition, the majority of the firing ranges used for conventional weapons are on the southern part of DPG, south of Stark Road, roughly 30 miles from the PFSF (see Exhibit 2), with the gun target line oriented to the south and southwest, away from the Goshute Reservation. Some firing is conducted in the vicinity of Wig Mountain, on the northern part of DPG (see Exhibit 2), but with the gun target line oriented to the northwest or southwest, away from the reservation and the PFSF. Furthermore, the distance from the normal weapon firing positions to the PFSF is greater than the range of the 155mm and 8 inch howitzers that represent the primary weapons systems fired at DPG. The nominal maximum range for the 155 millimeter howitzer is

18 kilometers or a little over 11 miles. The 8 inch howitzer has a nominal maximum range of 14 kilometers or about 9 miles. The ranges of the mortars, 60 and 81 millimeter (which are also fired at DPG), are considerably less. The Wig Mountain firing positions are closest to the PFSF and are located approximately 17 miles away to the west-southwest. The distance to the PFSF from the Wig Mountain Impact Area (which is the impact area closest to the PFSF) is approximately also 17 miles.[1]

9. I am aware of no incident in which people or property off of DPG were harmed by the firing of conventional weapons on DPG and I am aware of no incident in which a conventional munition fired or launched from DPG ever struck in the vicinity of the Goshute reservation. Therefore, because of the stringent range safety measures imposed at DPG, the orientation of most conventional weapons firing to the south and west—directly away from the PFSF, and the fact that the weapons fired at DPG (other than the MLRS) do not have the range to reach the PFSF, conventional weapon firing at DPG would pose no credible hazard to the PFSF.

B. The Use of MLRS

1. Overview and Description of MLRS

10. The MLRS is an artillery rocket launcher mounted on a tracked vehicle chassis. It carries a pod of 12 rockets that can be fired to a maximum range of 32 km (20 statute miles). The minimum range for the rockets is 5 km (3.1 statute miles). The areas that are potentially placed at risk by the firing of MLRS are depicted in Army Field Manual 6-60, "Tactics, Techniques, and Procedures for MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) OPERATIONS." The Manual identifies areas to the front and rear of the launcher.

[1] The gun firing positions for this impact area (which are different from the Wig Mountain firing positions) are located up to 11 miles to the south east of Wig Mountain, along East Downwind Road, and would be further away yet from the PFSF. See Exhibit 2.

11. The region at risk to the front of the firing point, i.e., toward the target or aim point, is defined by 1) the area around the aim point large enough to include all debris from the rocket and to contain the rocket if the fuse fails to function and 2) the exclusion area, which is the region between the firing point and the closest edge of the area around the aim point that would contain the rocket debris. See FM 60-6, Appendix J, at 4-9 (attached as Exhibit 3). The M28 training rocket is the only type of MLRS rocket that has been fired at Dugway.[2] The M28 has the same ballistic properties as the M26 rocket that would be fired from the MLRS in combat, but instead of the warhead of the M26, the M28 contains a spotting charge of three smoke canisters. For the M28, the region at risk to the front of the firing point extends no more than 4 km (2.5 miles) beyond the aim point (at longer firing ranges) and no more than 3.2 km (2 miles) to either side of the aim point (also at longer firing ranges). FM 60-6, App. J at 4-5.[3]

12. MLRS rockets are designed not to deviate significantly from the direction in which they are fired. The rocket follows a ballistic, free-flight (i.e., unguided) trajectory to the target. Thus, the rocket has no guidance system and hence there is no potential for a guidance system malfunction to cause deviation from the direction in which the rocket was fired.

13. The propulsion for each rocket is provided by an identical solid fuel rocket motor, so the rocket range (distance from the launcher to the impact point) is governed by the angle of elevation at which the rocket is fired. The rocket is initially stabilized by spin imparted through spin rails mounted on the inner wall of the rocket launch tube. After the rocket leaves the launch tube, four fins on the rocket deploy to maintain its spin.

---

[2] Electronic mail from Teresa Shinton, Freedom of Information Officer, Dugway Proving Ground (Jan. 12, 2000); Electronic mail from Teresa Shinton, Freedom of Information Officer, Dugway Proving Ground (Jan. 20, 2000). It is Army policy to issue only training rockets for peacetime training use. Conversation with Lt. Gen. Bob Moore, USA (Ret.) (Dec. 3, 1999) (Gen. Moore was involved with the development of the MLRS system as commander of Army Missile Command).

[3] For aim points at shorter ranges, the regions at risk are somewhat longer and wider relative to the aim point, but the region at risk extends farthest from the firing point when the aim point is at longer ranges.

The fins are mounted on the aft end of the rocket and are held down by wire rope retaining straps when the rocket is in the tube. As the rocket moves forward in the launch tube, lanyard devices trigger a delayed strap-cutting charge. After the rocket leaves the tube, the charge cuts the straps and the fins unfold and lock in position. The M28 training rocket launch pod container also has an additional fin release device to ensure the deployment of the rocket fins and further reduce the likelihood that a rocket would deviate from the direction in which it was fired. FM 60-6, Chap. 1 at 8.

14. According to FM 60-6, there are only two areas of danger to the rear of the MLRS firing point. One area is the Launcher Danger Area, which is the area to the rear of the launcher that is exposed to blast and debris. This area extends 400 m (440 yards) to the rear of the firing point. The other hazard area to the rear of the firing point is the Noise Hazard Area, which is the area to the rear of the launcher that can only be occupied by mission essential personnel wearing double hearing protection. This area extends an additional 500 m (550 yards) to the rear of the firing point (for a total hazard area extending 900 m (990 yards) behind the firing point). FM 60-6, App. J at 7.

2. MLRS Use on Dugway

15. In the past 12 years, the MLRS has been fired only twice on Dugway Proving Ground—once in 1988 and once in 1995.[4] The Dugway Proving Ground, Ranges and Training Areas Regulation identifies three impact area for training on Dugway into which the MLRS could conceivably be fired: the White Sage Impact Area, the Wig Mountain Impact Area, and the Causeway Impact Area.[5] The map attached to this declaration as Exhibit 4 shows the locations of the three impact areas.

---

[4] Electronic mail from Teresa Shinton, Freedom of Information Officer, Dugway Proving Ground (Jan. 12, 2000).

[5] Dugway Proving Ground Regulations, DPGR 350-2 (January 7, 1999), at 6-1 (attached as Exhibit 5).

16. In 1988, 36 M28 training rockets were fired into the Causeway Impact Area,[6] which, as shown on the map (Exhibit 4), is nearly 60 km (37 miles) southwest of the PFSF.[7] Some of these rockets were fired from the vicinity of Wig Mountain, which is roughly 27 km (17 miles) west-southwest of the PFSF. The other rockets fired into the Causeway Impact Area were fired from other, unknown locations on Dugway.

17. The firings into the Causeway Impact Area would pose no hazard to the PFSF. The maximum range of the MLRS is only 32 km (20 miles). Therefore, in order to hit the Causeway Impact Area, 60 km (37 miles) southwest of the PFSF, the firing location of the MLRS could be no closer than 28 km (17 miles) to the PFSF (60 km – 32 km = 28 km). Moreover, in such a case, the firing direction would have to be to the southwest, directly away from the PFSF, i.e., the PFSF would be 28 km (17 miles) directly behind the launcher. As FM 6-60 indicates, firing MLRS at a distant target would pose no danger whatsoever to a location 28 km (17 miles) behind the firing point.

18. If MLRS were fired into the Causeway Impact area on an azimuth toward the PFSF (i.e., from the opposite side of the impact area), the launcher would be over 60 km (37 miles) from the PFSF and hence would pose no hazard to the facility by virtue of being out of range.

19. In 1995, an unknown number of MLRS M28 training rockets were fired from the vicinity of Granite Peak, on Dugway, into the Wig Mountain Impact Area.[8] The 1995 firing points, aim points, and range safety area (derived from FM 6-60) are indicated on the map (Exhibit 4). The firing points were located approximately 50 km (31 miles) southwest of the PFSF and the aim points were located approximately 33 km (20 miles) west-southwest of the PFSF. The firings into the Wig Mountain Impact Area from

---

[6] 2nd Lt. Michael J. Norton, USA, memorandum to Commander, Dugway Proving Ground (August 3, 1988).

[7] The areas on the map at Exhibit 4 marked "Target Grids" are not impact areas in use on Dugway; they are old target areas that may contain unexploded ordnance or other hazardous materials.

[8] Lt. Col. Gaylen G. Whatcott, response to Freedom of Information Act request (December 20, 1999).

these firing points would pose no hazard to the PFSF in that they are approximately 50 km (31 miles) from the PFSF, well beyond the 32 km (20 mile) maximum range of the MLRS rocket (as indicated on the map in Exhibit 4).

20. Nor would any hazard be posed to the PFSF assuming that MLRS rockets might in the future be fired into the Wig Mountain Impact Area from different locations on Dugway. The only firing points on Dugway (shown on the map at the end of Exhibit 5) that are within range (32 km (20 miles)) of the PFSF are located such that MLRS rockets being fired into the Wig Mountain Impact Area from those points would be aimed away from the PFSF. Thus, for the reasons discussed above, MLRS rockets fired from these points would not pose a hazard to the PFSF.

21. Further, even if one were to assume that MLRS rockets could be fired into the Wig Mountain Impact Area in a direction from the southwest to the northeast, on an azimuth toward the PFSF (i.e., from the opposite side of the impact area),[9] such would still pose no hazard to the facility given the distance of the impact area from the PFSF. The boundary of the Wig Mountain Impact Area closest to the PFSF is 27 km (17 miles) away. As stated above, the minimum range of the MLRS is 5 km (3.1 miles). Given that aim points are not to be located at the very edge of the impact area (because account must be taken of the potential for rockets to fall within a region around the aim point as indicated above), any MLRS aim point would be located inside the impact area – not on the boundary edge – and therefore more than 27 km (17 miles) from the PFSF. That combined with the 5 km (3.1 mile) minimum range of the rocket would put the MLRS launcher for any possible MLRS firing scenario on an azimuth toward the PFSF more than 32 km (20 miles) from the facility, and thus out of range, even assuming that the MLRS aim points were located as close as allowable to the Wig Mountain Impact Area boundary closest to the PFSF.

[9] The map at the end of Exhibit 5 shows no firing points at any such locations.

22. In the last 12 years, no MLRS rockets have been fired into the White Sage Impact Area. Moreover, that impact area is located in the southeast corner of Dugway, the boundary of which is over 30 km (19 miles) south-southwest of the PFSF at its closest point. See Map at end of Exhibit 5. Thus, even if MLRS rockets were to be fired into the area in the future, they would have to be fired nearly directly away from the PFSF and hence they would not pose a hazard to the facility.

3. Conclusion Regarding MLRS

23. In conclusion, MLRS firing on Dugway Proving Ground would pose no credible hazard to the PFSF. Because of the great distance between the PFSF and the firing and impact areas on Dugway and the fact that the MLRS rockets are designed not to deviate significantly from the direction in which they are fired, an MLRS rocket fired on Dugway would not strike the PFSF.

I declare under penalties of perjury that the foregoing is true and correct.

Executed on December 29, 2000.

George A. Carruth

George A. Carruth

EXHIBIT 1
Carruth Declaration

George A. Carruth

6435 Alloway Court
Springfield, VA 22152

Home: (703) 569-7884
Office: (202) 488-6736

CURRENT POSITION:
Manager, System Integration

EDUCATION:
Tulane University, 1967-1969, Biology, PhD, 1973
University of Arkansas, 1956-1957, Animal Nutrition, MS, 1957
University of Arkansas, 1952-1956, Agriculture, BS, 1956
National War College, 1978
U.S. Army Command and General Staff College, 1971-1972
U.S. Army Chemical School, Radiological Safety, 1964

EXPERIENCE:

CRWMS M&O

System Integration **1991 – Present**

Summary of Responsibilities and Major Accomplishments
Responsible for development, implementation and maintenance of CRWMS program-level management plans, policies and procedures; system level technical baseline requirements documentation and OCRWM and M&O change control plans and procedures. Manage the development of system interfaces and integrates engineering and other technical activities to ensure achievement of technical baseline.

TRW Command Support Division

Project Manager **1987 – 1991**

Summary of Responsibilities and Major Accomplishments
Developed organization and concepts for the TRW team system engineering, development and management of the Nuclear Waste Management System for the Office of Civilian Radioactive Waste Management. Managed and developed Business Management Volume of the TRW Proposal. Researched and prepared business analysis of environmental services for TRW entry into market. Developed strategy, and directed technical and management sections of TRW's proposal for Program and Integration Support of the Army's Chemical Stockpile Disposal Program.

U.S. Department of the Army

Chief, Chemical and Nuclear Biological and Chemical Defense Division, Office of the Deputy Chief of Staff for Operations and Plans **1985 – 1987**

Summary of Responsibilities and Major Accomplishments
Developed and managed the Army's chemical warfare, nuclear, biological, and chemical defense policies, programs, and plans. Responsible for budget information and execution; doctrine; material requirement definition; and material life cycle management to include disposal of toxic chemical structure development; and material life cycle management to include disposal of toxic chemical munitions and agents. Maintained an annual program of $1 billion during period of severe budget reductions. Provided leadership for the development of the first Joint Service Chemical Warfare and Chemical Biological Defense Research

Development and Acquisition Plan that provides prioritized material, science and technology, and data requirements supporting resource needs to all the armed services. Guided development of the congressionally-mandated concept plan for the destruction of the national stockpile of toxic chemical agents and munitions on a very constrained schedule. Conducted and planned three program alternatives within average cost of $2 billion each. Briefed, and was a witness, before key congressional committees, members, and staffers on the Fiscal Year 1986 and 1987 Department of Defense Presidential Budget Requests. Gained congressional support/funding for the chemical warfare program including funding for production of binary chemical weapons.

Deputy Commander **1984 – 1985**
U.S. Army Nuclear and Chemical Agency

Summary of Responsibilities and Major Accomplishments
Provided daily direct supervision to the Army Nuclear and Chemical Agency, the only organization dedicated to provide technical support on nuclear and chemical matters to the Army in a tactical area. Provide top-level guidance on policy for the safety, security, and reliability of three of the Army's nuclear and chemical weapons. Supervised preparation of employment manuals for all Army weapons and those of other services used to support the Army in the field.

Commander **1981 – 1984**
Dugway Proving Ground

Summary of Responsibilities and Major Accomplishments
Managed the Army Dugway Proving Ground, DoD's only chemical warfare, chemical and biological defense and smoke major range and test facility. Planned, conducted, and reported on a wide variety of highly technical test projects representing over 45,000 man-hours of effort. Originated and guided to completion, a comprehensive plan for the modernization of the test facility to include increase in personnel and improved instrumentation, facilities, housing, utilities, and communications. Directly supervised the operation of an isolated 2,500-person community including housing, medical care, law enforcement, fire protection, utilities, and support facilities.

Chief, Nuclear and Chemical Office **1978 – 1981**
U.S. Army Material Development Readiness Command

Summary of Responsibilities and Major Accomplishments
Directed development of environmental documentation for several major Army programs to include controversial projects such as movement of chemical weapons for Colorado to Utah and the chemical stockpile program. Exercised major headquarters responsibility for the safety and the security of the majority of the Army Material Development and Readiness Command's chemical weapons and two of the largest nuclear depots to include responsibility for accident/incident control, physical security site-upgrade program, and personnel reliability program.

Staff Engineer **1975 – 1977**
Chemical Division, Office of the Deputy Chief of Staff
For Operations and Plans

Summary of Responsibilities and Major Accomplishments
Point of contact for all matters affecting nuclear, biological and chemical training, readiness, doctrine, equipment, and employment of chemical munitions for Headquarters, Department of the Army. Conducted joint service planning and coordination of program with Office of the Secretary of Defense and the other

Services. Lead team that conducted detailed review of the U.S. Army's Chemical Warfare Posture and developed a comprehensive program plan for correcting identified deficiencies.

As Chief of the Trails Branch Staff Studies and Trails Wing (1972 – 1974), served as Exchange Officer to the British Defense NBC School responsible for planning, coordinating, and directing tests of British NBC defense equipment and doctrine.

As Chief of the Radiological Division (1970 – 1971), presented nuclear weapons employment and radiology safety to all students at the U.S. Army Chemical School.

As Chemical Officer and Deputy Operations Officer (1969 – 1970), planned and operated the control room for monitoring and directing military operations in the largest corps area in Vietnam.

Executive for Plans and Training (1964 – 1967), for all U.S. Army forces in Panama.

Instructor for Plans and Training (1962 – 1964), for the U.S. Army Chemical School.

Instructor and Company Executive Officer (1960 – 1962), prepared and presented instruction to combined officer and enlisted courses on jungle and amphibious small unit operations for the Ranger Department in the U.S. Infantry School.

Research Biochemist (1957 – 1959), for the U.S. Army Biological Warfare Laboratory.

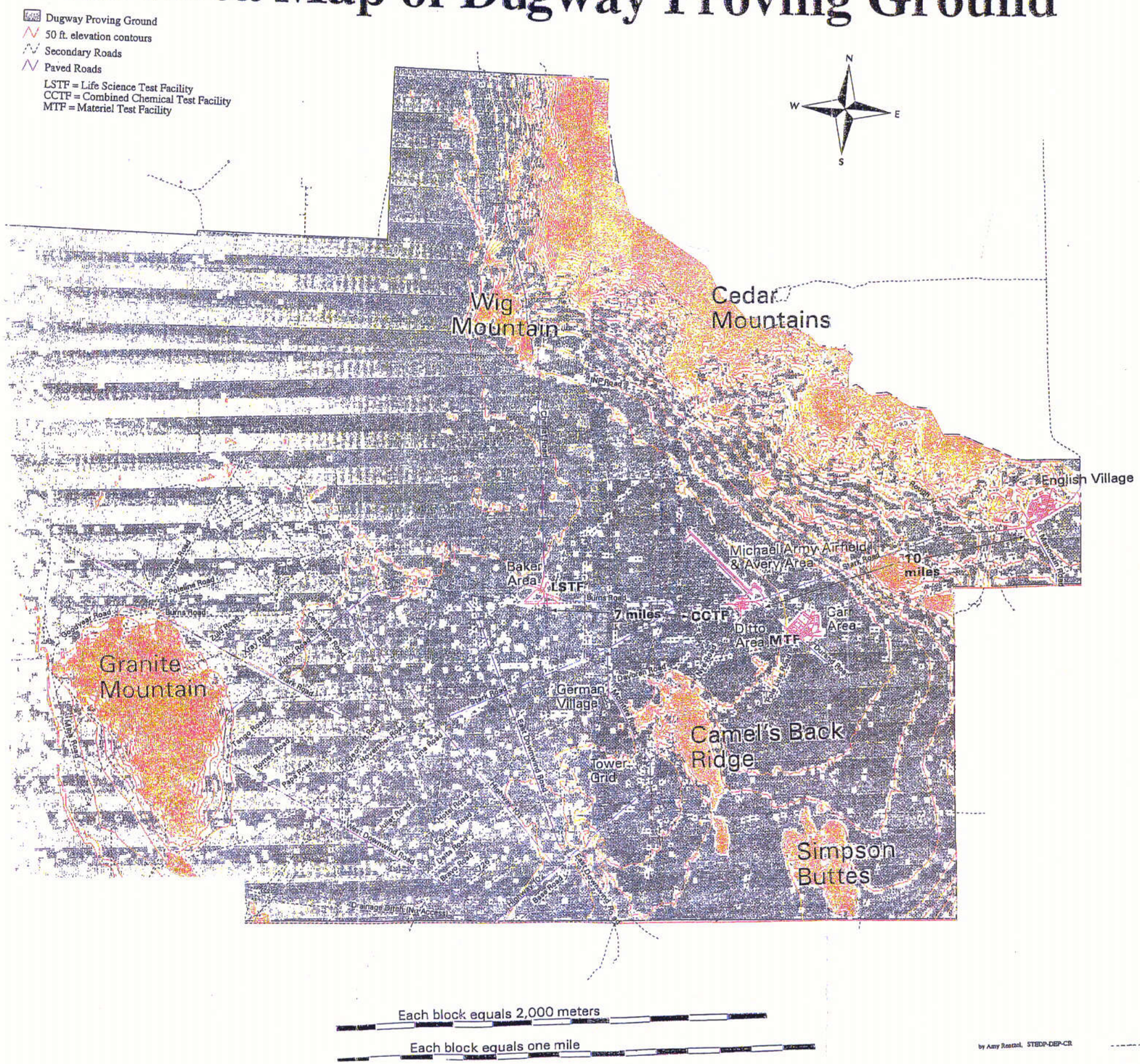
Awards/Accomplishments/Publications/Patents/Other

Memberships
National Science Foundation Fellowship (for MS)
National Science Fellowship (for PhD)
Sigma Xi

Awards
Legion of Merit (three awards)
Bronze Star
Army Commendation Metal (three awards)

EXHIBIT 2
Carruth Declaration

East Area Map of Dugway Proving Ground



by Amy Rentzel, STEDP-DEP-CR

EXHIBIT 3
Carruth Declaration

APPENDIX J

SAFETY

Safety is always a prime consideration of soldiers and trainers at all levels, especially when training exercises use live ammunition. Often, the implementation of safety procedures becomes counterproductive, preventing units from conducting realistic live-fire training. Units must be able to conduct realistic training using live or training ammunition while meeting all safety requirements. The procedures in this chapter are based on the principles of artillery safety in AR 385-63 and cover peacetime safety practices and procedures for MLRS firing. Units following these procedures can conduct safe, effective life-fire training exercises.

Section I

RESPONSIBILITIES AND PROCEDURES

Responsibilities

AR 385-63, Chapter 11, implements the chain-of-command safety concept. Under this concept, the firing battery chain of command is responsible for safety during firing in both training and combat. This chapter reinforces AR 385-63, however, if local range regulations are more restrictive than the material in this chapter, the local range regulations must be followed.

Range Control/Installation Range Officer

The installation range officer provides to the officer in charge (OIC) a range safety card. This card states the location coordinates of the launcher firing area and the location coordinates of the target(s) to be engaged. The range officer also identifies any special instructions that must be followed in firing at that range (road guards, time constraints, Air Force overflights, and so on). He is responsible for constructing and verifying surface danger zones for MLRS firing areas. He prepares and maintains all waivers IAW AR 385-63. All waivers must be approved by a general officer at the installation command level.

Commanders of Field Artillery Units

Commanders establish and maintain a safety training and certification program for their unit personnel. The purpose of this program is to train and qualify individual members of the firing battery in the safety procedures for their specific areas of responsibility. When the responsible commander is satisfied that the individual members are qualified to perform the safety duties as required in the firing battery, he certifies them as competent to perform those duties. The FA battalion commander is responsible for safety during all phases of a firing exercise under his control. He selects, trains, and certifies the personnel necessary to help him discharge this responsibility.

These personnel include, but are not limited to, the firing battery commander, battery operations officer, firing platoon leader, fire direction computers, and launcher section chiefs. If any position is not filled by a command safety-certified person, another person who is certified and qualified to fill that position performs the safety checks.

Officer in Charge

The OIC is the battery commander or his command safety-certified direct representative. The OIC is responsible for all aspects of safety in the firing unit and on the assigned firing range. Before the firing exercise, the range control officer provides the OIC the required safety data and any firing limitations. The OIC verifies that the unit is in the proper firing position. He supervises the conversion of the safety data into a safety diagram and ensures that this diagram is verified by another command safety-certified person. The OIC is responsible for ascertaining locations of friendly personnel who may inadvertently become exposed to artillery fires through the installation range safety officer. He ensures dissemination of this information to platoon leaders, platoon sergeants, and chiefs of section, as appropriate, so they are aware of potential situations which might result in fratricide.

Firing Platoon Leader

The firing platoon leader is responsible for the safety practices of the firing element. He ensures that section chiefs report firing data to the POC/BOC. He ensures that the launcher danger area is clear.

Platoon Sergeant

The platoon sergeant assists the platoon leader in his duties. He must be prepared to perform any of the platoon leader's duties in his absence.

Section Chief

The launcher section chief is responsible for the operation of his crew from the reload point through rocket launch(es). He ensures that all procedures in the launcher are conducted in accordance with applicable technical manuals and that all reports and checks are verified in accordance with the procedures outlined in this chapter. He is ultimately responsible for ensuring munitions are neither armed nor fired until firing data is properly verified as safe. Specific duties of the section chief are contained in subsequent paragraphs.

Procedures

The MLRS launcher FCS is designed to perform many repetitive self-tests during operations. Built into both the launcher hardware and software, these tests check and continually monitor the launcher throughout its operation. Additional manual checks should focus on crew-error, the area which has caused most launcher-related firing incidents. Checks which verify all data input into the FDS and launcher FCS eliminate most of the causes of firing incidents.

MLRS firing data (azimuth, quadrant elevation, and fuze setting) are computed by the FCS. The FCS conducts internal tests, all of which must be within system accuracy tolerances, before allowing the launcher to fire. To complete a firing sequence, the LLM must be oriented and maintain accuracy within ±3 mils of the FCS ballistic solution (CMD vs actual data displayed on the FCP). If for any reason the launcher drive system (LDS) fails, (part wear, adverse mechanical failure, etc.) preventing the LLM from reaching or maintaining its computed ballistic firing window, the FCS will cancel the fire mission and not allow the crew to fire the rockets. Additionally, during the conduct of every fire mission, the FCS further verifies its LLM position by comparing its data against a mechanical reference provided by azimuth and angle position transducers. These transducers are fitted to the

rotating band of the launcher turret and the launcher elevation actuator. A failure of agreement between the FCS and its mechanical resolvers will alert the crew through a warning message. Any indication of a system error (BIT light or prompt on the FCP) will cause the crew to immediately abort the mission in progress and troubleshoot the fault before continuing.

Operator error is minimized through verification of launcher firing data. This verification must be made by a safety certified individual. The independence of this check is maintained in one of two ways:

- By ensuring data input is by two different methods for the firing and check launchers (i.e., manual entry vs data transmission) when conducting static firings. This includes meteorological data, update and target grid coordinates, altitudes and grid zones. It also consists of a comparison of the command firing data from a calibrated launcher FCS (firing launcher) and computed data from an independent launcher (non-firing).
- By ensuring data input is observed by two safety certified personnel (e.g., gunner and section chief for the FCS; fire direction computer and operations officer for the FDS). It also includes a check by both the gunner and section chief of the actual firing data to ensure it falls within the safety "T" when conducting live fire exercises using the safety computations in Section II.

Additionally, the PADS-established SCP must always be verified. A hard copy of the data is sent via a location status message to the BOC and POC, where it is validated and retained. The BOC and POC file this information for historical record. In the BOC and POC, the operations officer (BOC) and platoon leader (POC) verify that the met data and impact area target location were correctly entered by the FDS operator and transmitted digitally to the firing launcher(s), where the data are automatically entered into the FCS. This independent verification of start-up data by the launcher section chief and the platoon leader ensures that accurate position data are used during fire mission computation. The gunner ensures, and the section chief verifies, that start-up and update data are properly entered into the launcher FCS.

The tolerances within which the launcher can accurately position and fire during practice firings are identical to those used in a tactical situation. This enhances tactical realism during training and validates the system capability. Procedures for firing safety involve a properly calibrated launcher, verification that the FCS is functioning properly, and verified launcher firing position within a designated firing area. Strict adherence to the operator's manual procedures and/or warning indicators and a hard copy of the launcher firing ballistic solution sent via a MFR to the BOC and POC for historical record are required.

Use of observers located near and properly oriented on the impact area to observe a warhead event (M28) or safe impact (M28A1) for safety verification depends on local installation range SOP. If spotting of the warhead is required, visual observers or radar tracking (AN/TPQ-37) may be used. A sample MLRS firing safety checklist is provided at the end of this Appendix.

Section II

COMPUTATION OF SAFETY DATA (M28 and M28A1 Training Rockets)

Units using these procedures must be thoroughly familiar with the applicable terms and basic safety computations for each of the training rockets (M28 and M28A1) contained in AR 385-63. These procedures incorporate the procedures for developing the surface danger zones (SDZs) contained in that regulation. They apply the SDZ requirements around an installation impact area rather than a specific target. They also apply the launcher danger areas to either individual firing points or a larger

firing OPAREA. In the event of a conflict, AR 385-63 has precedence. The examples described herein are based on the M28A1 Training Rocket (reduced range).

General

There are three methods to compute safety data for MLRS live-firing. The first of these is for point-to-point firings using the SDZ diagrams contained in AR 385-63 and the safety checklist at the end of this appendix. The other two methods allow the unit to develop a safety "T" for either a firing point or a firing OPAREA. Both of these latter methods apply all of the SDZ requirements established in AR 385-63.

The first method allows the unit to derive a safety "T" for a single firing point firing into a "target selection box." The second method requires a larger impact area, but allows the unit to derive a single safety "T" for an entire launcher OPAREA firing into a target selection box. Both of these latter methods allow the unit to conduct more realistic and tactically driven live-fire exercises, thus significantly enhancing training.

OPAREA safety works well when conducting live-fire exercises with the M28A1 Training Rocket (reduced range). Although these procedures can be used with the standard M28 Training Rocket, its much larger values for W, X, and Y (see *Definition of Terms*) necessitate exceptionally large installation impact areas (see Tables J-1 and J-2). Inordinately small impact areas may preclude the use of these procedures with the M28A1 Training Rocket (reduced range) as well.

Table J-1. M28 Safety Values

	RANGE TO TARGET (m)	W	X	Y
M28	10,000 to 11,500	1,160	8,000 + H	2,200
	11,501 to 15,000	1,320	6,300 + H	2,200
	15,001 to 20,000	1,620	5,000 + H	2,200
	20,001 to 23,000	1,820	3,200 + H	2,200
	23,001 to 27,000	2,220	3,600 + H	2,200
	27,001 to Maximum	3,220	4,000 + H/2	2,200

Table J-2. M28A1 Safety Values

	RANGE TO TARGET	W	X	Y
M28A1	8,000 to 9,000	580	2,450	1,930
	9,001 to 10,000	620	2,100	1,500
	10,001 to 11,000	685	1,800	1,180
	11,001 to 12,000	760	1,560	900
	12,001 to 13,000	850	1,475	600
	13,001 to 14,000	950	1,580	450
	14,001 to 15,000	1,050	1,760	350

Safety computations for each of these methods are completed in four phases. *Phase I* is the application of the SDZ requirements (for the specific munition) to the installation impact area. *Phase II* is the derivation of the firing limits in both azimuth (AZ) and quadrant elevation (QE). *Phase III* is the application of the SDZ requirements (for the specific munition) to the launcher firing point or OPAREA. *Phase IV* is the completion of the flight corridor.

Definition of Terms

AoF Azimuth of Fire.

H Height of the launcher above mean sea level.

W A distance to either side of the target wide enough to include all debris (payload, warhead skin, and rocket motor) from normally functioning rounds.

W_{max} The maximum possible value of W. For OPAREAs, this is the value of W at a range from the rear edge of the OPAREA to the target (maximum range).

X A distance beyond the target adequate to contain rockets when the fuze fails to function.

X_{max} The maximum possible value of X. For OPAREAs, this is the value of X at a range from the forward edge of the OPAREA to the target (minimum range).

Y A distance short of the target sufficient to include all debris (payload, warhead skin, and rocket motor) from normally functioning rounds.

Y_{max} The maximum possible value of Y. For OPAREAs, this is the value of Y at a range from the forward edge of the OPAREA to the target (minimum range).

Note: When firing the standard M28 training rocket. 320 meters has already been added to the value of W (to account for Area A), 1,300 meters has already been added to the value of X (to account for Area B), and Y will always equal 2,200 meters. W and X values for the M28A1 training rocket by definition include areas A and B respectively.

Firing Point Method

Phase I

Apply the SDZ requirements to the installation impact area:

STEP 1. Outline the usable portion of the installation impact area. Index the approximate geographic center of this area (target).

STEP 2. Index the firing point.

STEP 3. Draw a line segment connecting the two indices from steps 1 and 2.

STEP 4. Apply the values of W_{max}, X_{max}, and Y_{max} to the edges of the installation impact area (toward the target). These values should be based on ranges from the firing point to the near edge (minimum range) and far edge (maximum range) of the installation impact area. This is the *SDZ Impact Area.*

Phase II

Determine the Left and Right Azimuth Limits.

STEP 1. Draw line segments from the firing point to the right and left edges of the SDZ Impact Area which will keep all rounds within the SDZ Impact Area (safety fan). You must also apply any azimuth restrictions imposed by the installation safety office for the firing area. (See Figure J-1.)

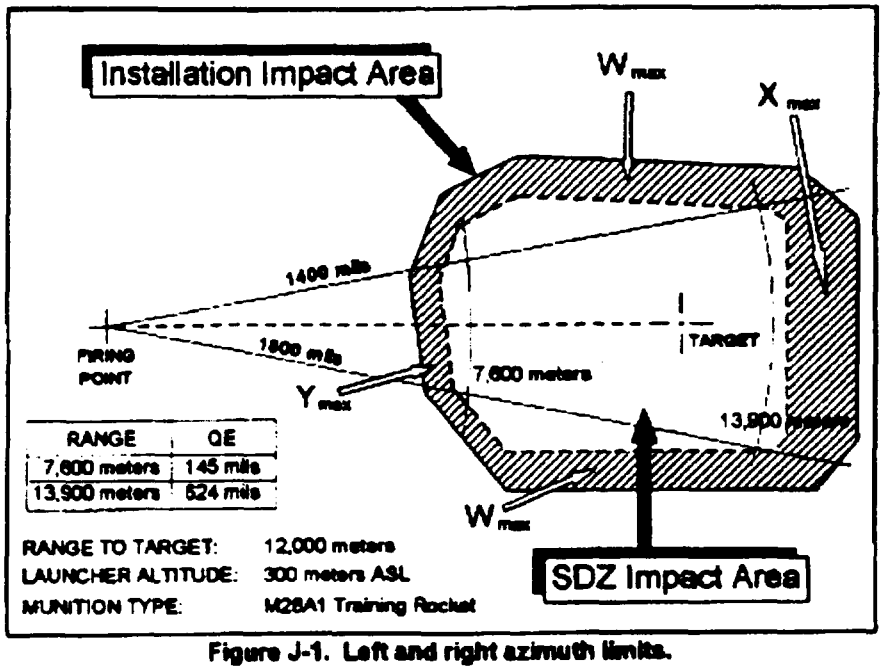


Figure J-1. Left and right azimuth limits.

Derive the Minimum and Maximum Values for Quadrant Elevation (QE).

STEP 2. Measure the minimum and maximum ranges to the near and far edges of the SDZ impact area (within the azimuth limits). You must also consider min and max range limits imposed by the range safety office. Using the current MET message, determine the associated firing azimuths and QEs with a launcher FCS by dry firing missions at the lower left and upper right corners. The lower left mission will determine the left azimuth limit and min QE. The upper right mission will determine the right limit and max QE. This completes the safety "T" for firing point method (see Figure J-2).

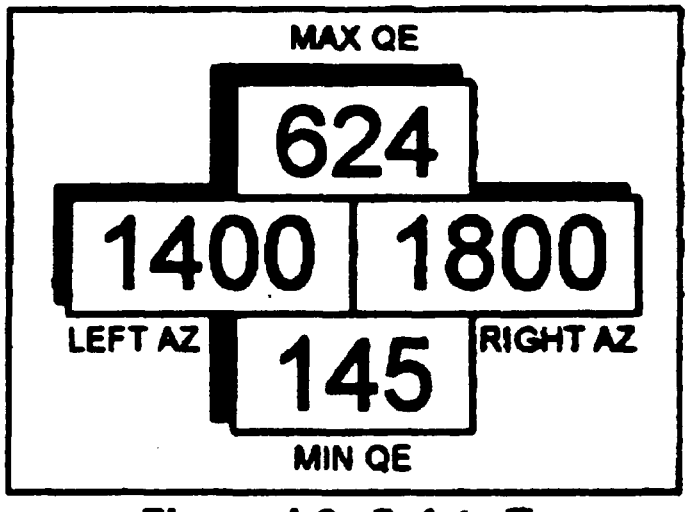


Figure J-2. Safety T.

Phase III

Complete the Launcher Danger Areas.

STEP 1. *Area F* (Launcher Danger Area) is the area immediately to the rear of the launcher which is directly exposed to blast and debris. It extends 350 meters to the left and right of the launcher firing point (perpendicular to the AoF) and 400 meters to the rear of the firing point (parallel to the AoF). Personnel are prohibited from occupying this area.

STEP 2. *The Noise Hazard Area (NHA)* extends behind Area F. It can only be occupied by mission essential personnel wearing double hearing protection. Draw a box that extends beyond Area F an additional 300 meters (500 meters for the M28 rocket) to the rear of the firing point (Figure J-3).

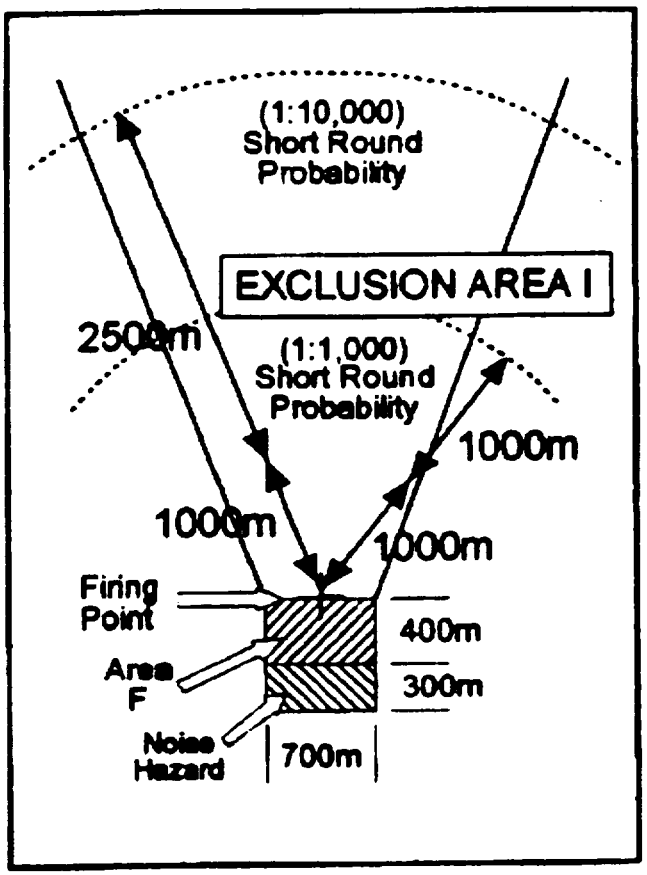


Figure J-3. Noise hazard area.

Phase IV

Complete the Flight Corridor

STEP 1. Construct line segments from the left and right forward edge of Area F to the left and right near edge of the Installation Impact Area respectively that are parallel to the left and right azimuth limits (see Figure J-4).

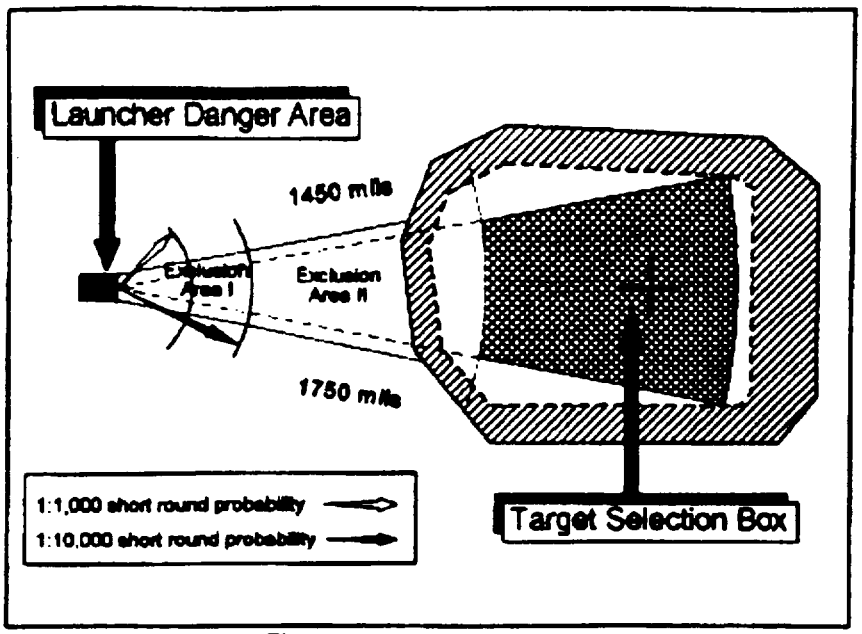


Figure J-4. Flight corridor.

STEP 2. The *Exclusion Area* is that area of the SDZ flight corridor within a specified distance of the downrange edge of the firing area. It is endangered by failure of the rocket motor (or early warhead event for the M28 rocket) during the boost phase. The distance is based on acceptance of risk (approved by the installation commander IAW AR 385-63).

Exclusion Area I

STEP 2a. Construct an arc, centered on the firing point, with a radius derived from Table J-3 (based on the level of accepted risk for Exclusion Area I). The area between the arc and the firing point is Exclusion Area I.

Table J-3. Exclusion Areas

SHORT ROUND PROBABILITY	EXCLUSION AREA I		EXCLUSION AREA II		EXCLUSION AREA III	
	M28	M28A1	M28	M28A1	M28	M28A1
1 per 1,000 Firings	1,000 m	1,000 m	See Note 1	See Note 2	1,800 m (Note 3)	N/A
1per 10,000 Firings	4,700 m	2,500 m	See Note 1	See Note 2	1,800 m (Note 3)	N/A

Notes: [1]This distance will vary based on range to target and the size of the impact area. It is the area between Exclusion Area I and Exclusion Area III.
[2]This distance will vary based on range to target and the size of the impact area. It is the area between Exclusion Area I and the SDZ impact area.
[3]This distance is measured from the near edge of the SDZ impact area toward the firing point.

Note: The use of a 1:1,000 or 1:10,000 short round probability is used when calculating risk under waiver IAW AR 385-63.

Exclusion Area II

STEP 2b. The area between the arc of Exclusion Area I and the forward edge of the SDZ Impact Area is Exclusion Area II for the M28A1 Training Rocket (reduced range). Exclusion Area II for the M28 Training Rocket is that area between Exclusion Areas I and III.

Note: Exclusion Area II can only be occupied under waiver IAW AR 385-63. Exclusion Area I and III cannot be occupied.

Exclusion Area III

STEP 2c. This *Exclusion Area* applies only to the M26 Tactical and M28 Training Rockets. It is the area within the flight corridor that begins at the near edge of the SDZ impact area and extends 1,800 m toward the firing point.

The AZ and range limits determined in Phase I also describe a small area around the target. This is the target selection box. All targets selected from within this box will fall within the safety "T" for the firing point.

OPAREA Method

Phase I

Apply the SDZ requirements to the installation impact area (see Figure J-5):

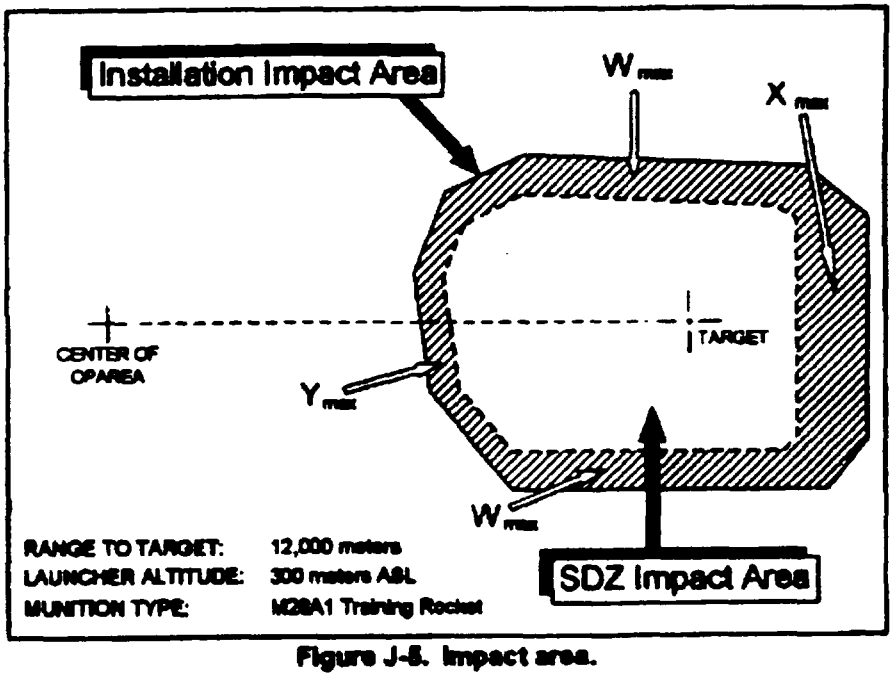


Figure J-5. Impact area.

STEP 1. Index the approximate geographic center of the installation impact area (target).

STEP 2. Index the center of the proposed firing OPAREA. Draw a circle around the index with a one kilometer radius. This distance may be larger or smaller depending upon the training area available to the unit.

STEP 3. Draw a line segment connecting the two indices from steps 1 and 2.

STEP 4. Apply the values of W_{max}, X_{max}, and Y_{max} to the edges of the installation impact area (toward target). This is the *SDZ Impact Area.*

Phase II

Determine the Left and Right Azimuth Limits of the OPAREA.

STEP 1. Mark the most forward rearward, right, and left positions along the circumference of the OPAREA circle from Phase I.

STEP 2. Draw a safety fan from both the left and right positions (from step 1) which will keep all rounds within the SDZ Impact Area. You must also apply any azimuth restrictions imposed by the installation safety office for the firing area. Measure the left and right limits of each fan (see Figure J-6). These are the initial left and right azimuth limits for the entire live-fire OPAREA. (You will determine the final azimuth limits with FCS in step 8.)

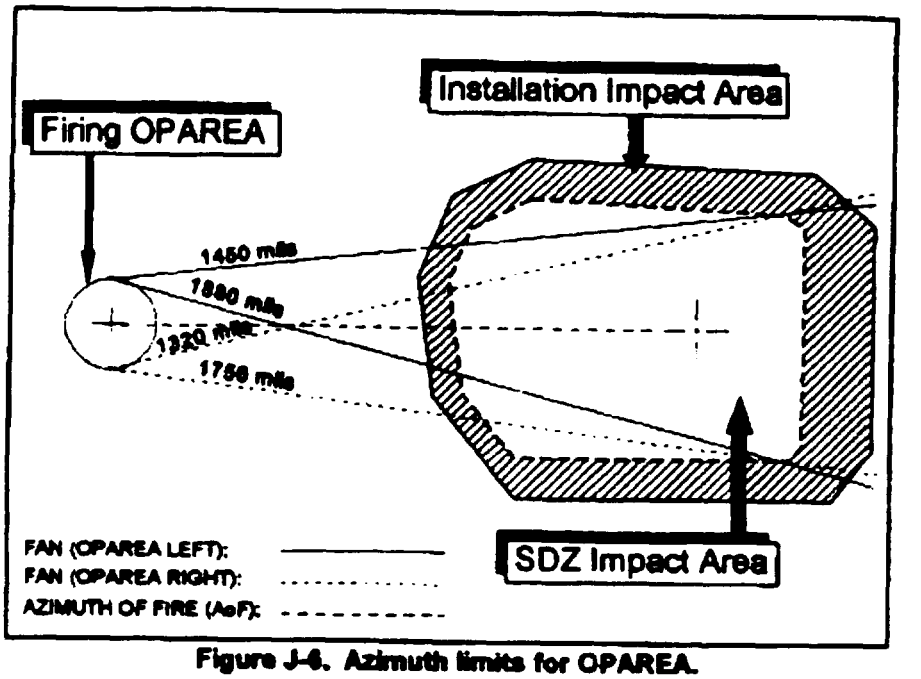
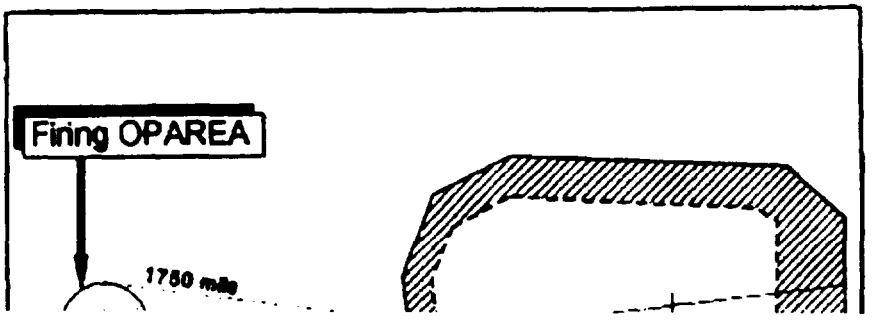


Figure J-6. Azimuth limits for OPAREA.

STEP 3. Apply the lower (or leftmost) value of the *left* azimuth limits (derived from the leftmost position) to the rightmost position. Apply the higher (or rightmost) value of the *right* azimuth limits (derived from the rightmost position) to the leftmost position. Ensure these limits are marked separately and distinctly from the previous fans. They will be used to complete a "target selection box" later (see Figure J-7).



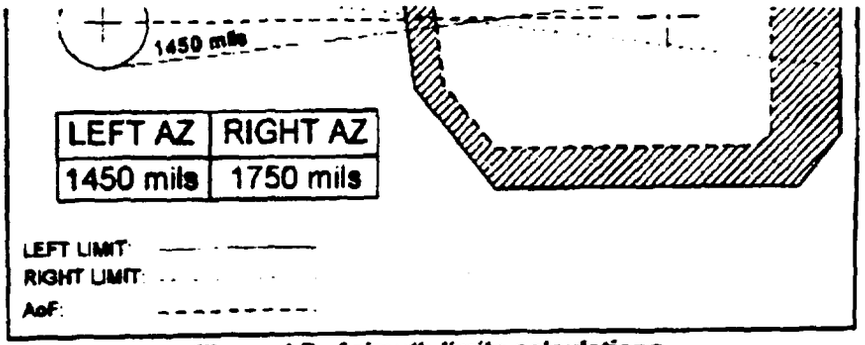


Figure J-7. Azimuth limits calculations.

Derive the Minimum and Maximum Values for Quadrant Elevation (QE).

STEP 4. Measure the minimum and maximum ranges (2 each) from both the forward and rear OPAREA positions to the near and far edges of the SDZ impact area (within the azimuth limits). You must also consider minimum and maximum range limits imposed by the installation range safety office (Figure J-8).

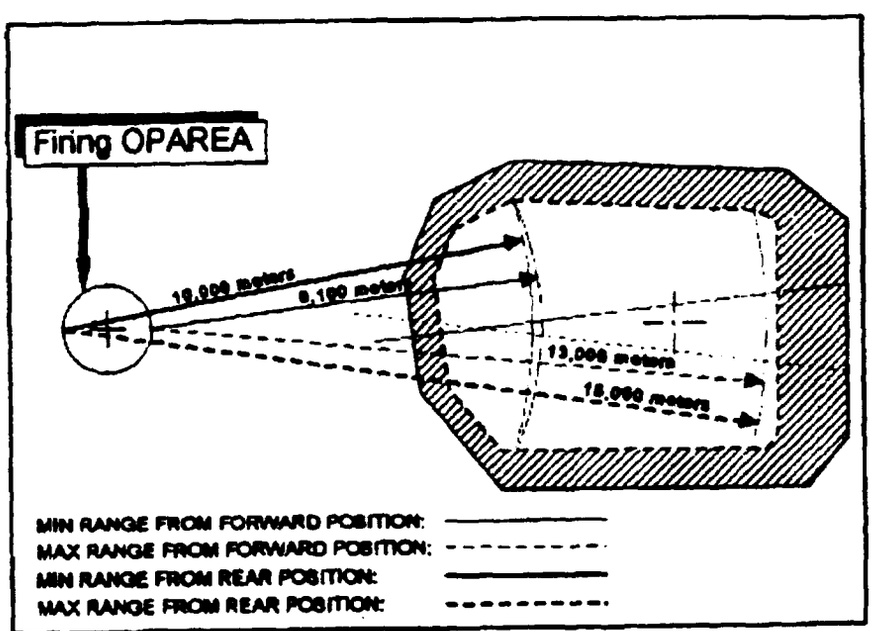
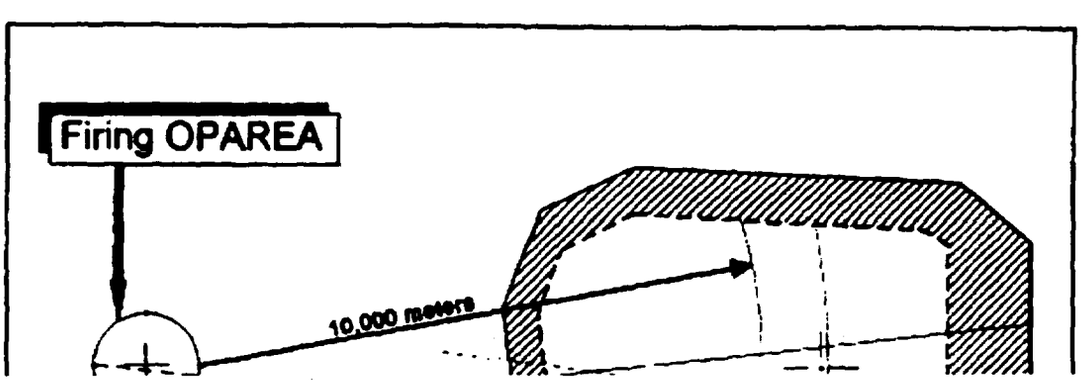


Figure J-8. Range limits calculations.

STEP 5. Derive the OPAREA minimum range by applying the minimum range from the rear position of the OPAREA to the forward position of the OPAREA (Figure J-9).



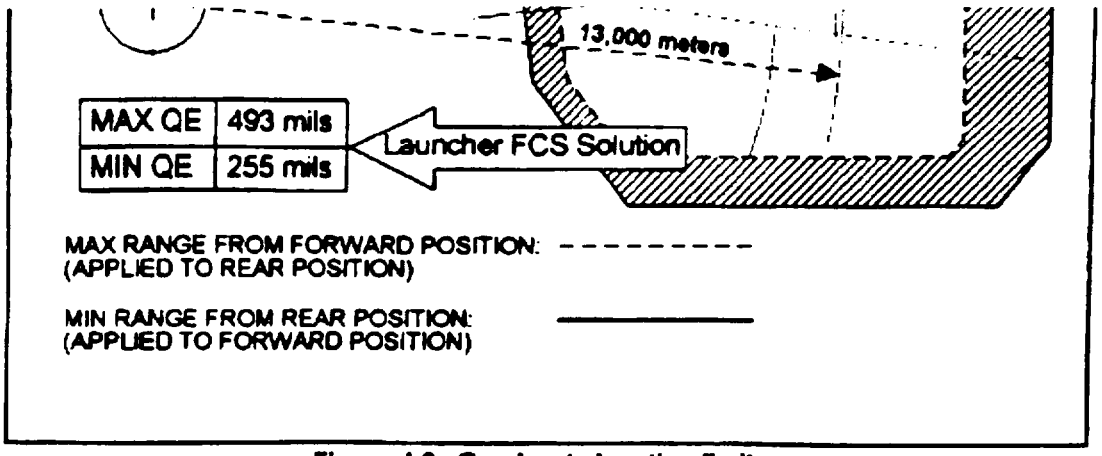


Figure J-9. Quadrant elevation limits.

STEP 6. Derive the OPAREA maximum range by applying the maximum range from the forward position of the OPAREA to the rear position of the OPAREA (Figure J-9).

STEP 7. Draw the associated range arcs, intersecting both the left and right azimuth limits from step 3.

STEP 8. Compute the safety T using the FCS with the current met to fire four dry missions from left, right, front, and rear OPAREA extremes as listed below.

Mission 1. Forward most OPAREA position to the lower left corner. This yields the min QE.

Mission 2. Rearward most OPAREA to the upper left corner. This yields the max QE.

Mission 3. Left most OPAREA to the lower right. This yields the right azimuth limit.

Mission 4. Right most OPAREA to the lower left corner. This yields the left azimuth limit.

This completes the safety "T" that establishes firing limits for the launcher within the OPAREA (Figure J-10).

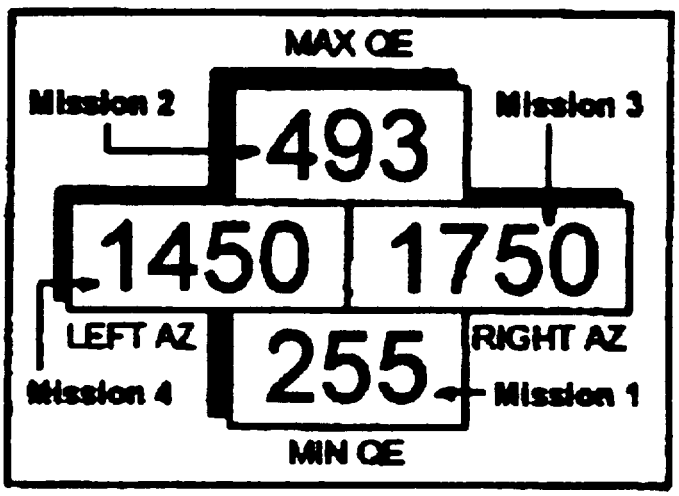


Figure J-10. Safety T.

Phase III

Apply the SDZ requirements (for the specific munition) to the launcher OPAREA and complete the flight corridor.

This phase applies the Launcher Danger Area (Area F) and Noise Hazard Area requirements to the OPAREA to determine a "worst case" diagram. This is accomplished by applying those requirements around the rear half of the circumference of the OPAREA (Figure J-11). Although these actual danger areas are a function of the specific launcher location, controlling entry to the areas derived in this phase will allow more freedom of movement for the launcher, thus adding realism to the live-fire training exercise.

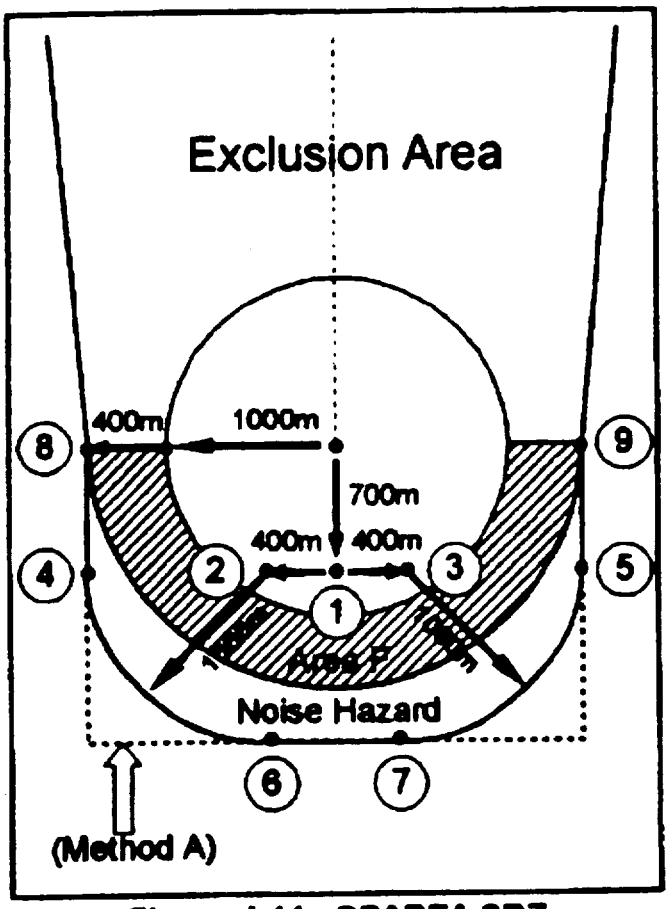


Figure J-11. OPAREA SDZ requirements.

STEP 1. *Area F* (Launcher Danger Area) is the area immediately to the rear of the launcher which is directly exposed to blast and debris. Divide the OPAREA in half by drawing a line through its center, perpendicular to the AZ to the target constructed in Phase I. Extend outward along this line to a point 400 meters on each side around the rear half of the OPAREA. (See the shaded area of Figure J-11).

STEP 2. *The Noise Hazard Area (NHA)* extends an additional 300 meters behind Area F. It can only be occupied by mission essential personnel wearing hearing protection. There are two means of constructing the NHA. The first is the most simple, while the second method minimizes the size of the NHA thus allowing less use of training land. To construct the OPAREA NHA:

Method A:

STEP 2a. Draw a box that extends 1400 meters to the left and right, as well as 1700 meters to the rear, of the center of the firing OPAREA. The result is a box 2800 meters wide and 1700 meters deep. Go to Phase IV.

Method B:

STEP 2b. Place an index at a point 700 meters to the rear of the center of the OPAREA along the AoF (see Figure J-11, point number 1).

STEP 3b. Place two more indices 400 meters to the left and right of the first index, perpendicular to the AoF (points 2 and 3).

STEP 4b. From each of these last two indices, construct a 1000 meter radius arc through points 4 and 5 respectively (1600 mils).

STEP 5b. From points 4 and 5 extend line segments forward so that they are tangent to Area F at points 8 and 9 respectively.

STEP 6b. Connect the two arcs in the rear (between points 6 and 7) with a line segment to complete the rear edge of the NHA.

Phase IV

STEP 1. Construct line segments from points 8 and 9 forward to the near edge of the Installation Impact Area. The line segments should be parallel to the left and right azimuth limits respectively. Since these line segments begin at points 400 m to the left and right of the OPAREA, Danger Area A (320m) has been accounted for. This describes the general flight corridor (see Figure J-12).

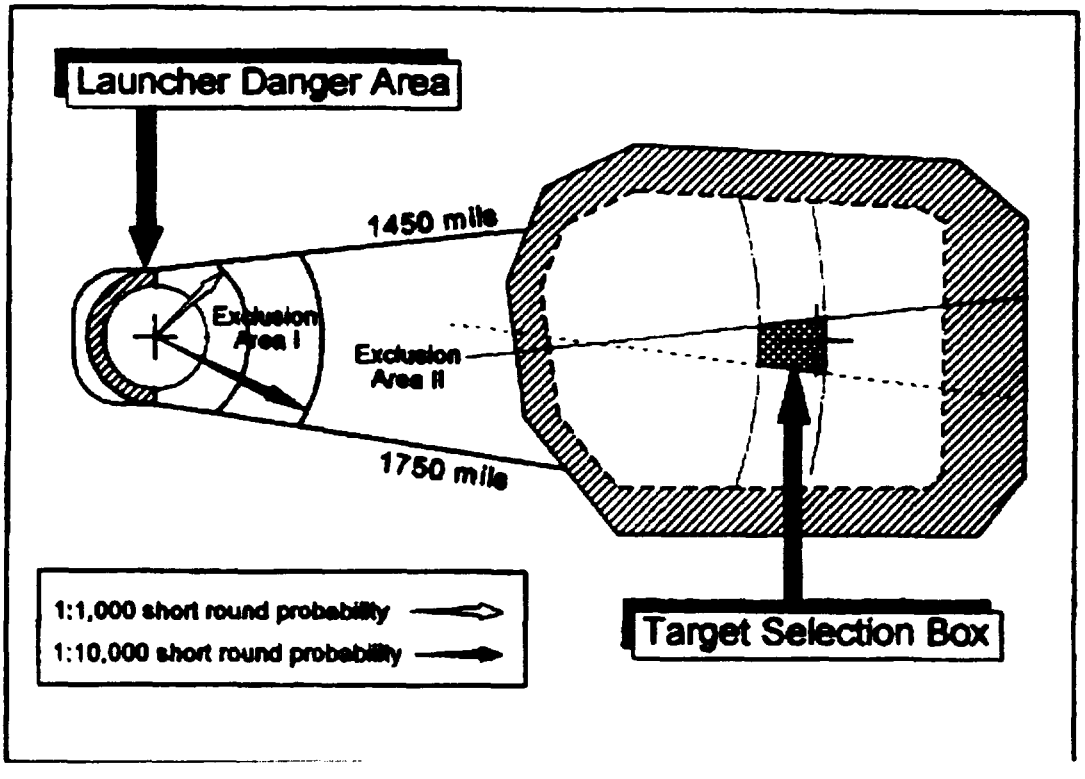


Figure J-12. Exclusion areas.

STEP 2. The *Exclusion Area* is that area of the SDZ flight corridor within a specified distance of the far edge of the firing area. It is endangered by failure of the rocket motor during the boost phase. The distance is based on acceptance of risk (approved by the installation commander IAW AR 385-63).

Exclusion Area I

STEP 2a. Construct an arc, from the center of the OPAREA, with a radius that extends beyond the OPAREA by the distance in Table J-3 (based on the level of accepted risk for Exclusion Area I). The area between the arc and the front of the OPAREA is Exclusion Area I. The example in Figure J-13, shows both a 1:10,000 short round probability (2,500 m) and a 1:1,000 short round probability (1,000 m). The use of a 1:1,000 level of acceptable risk must be done under waiver IAW AR 385-63.

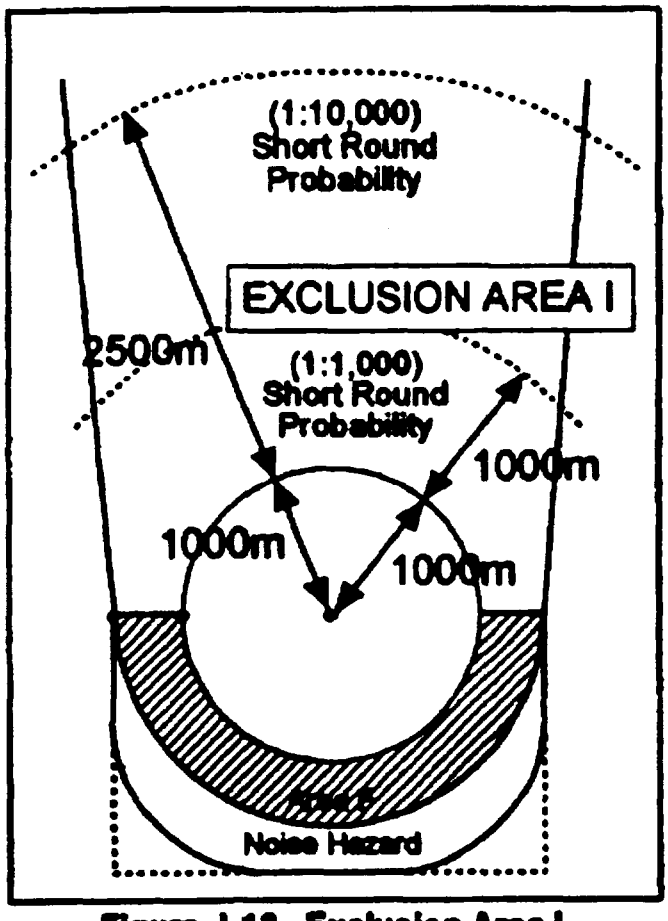


Figure J-13. Exclusion Area I.

Exclusion Area II

STEP 2b. The area between the arc of Exclusion Area I and the front of the OPAREA is Exclusion Area II for the M28A1 Training Rocket (reduced range). Exclusion Area II for the M28 Training Rocket is that area between Exclusion Areas I and III. Exclusion Area II can only be occupied under waiver IAW AR 385-63. Exclusion Area I and III cannot be occupied.

Exclusion Area III

STEP 2c. This *Exclusion Area* applies only to the M26 Tactical and M28 Training Rockets. It is the

area within the flight corridor that begins at the near edge of the SDZ impact area and extends 1,800 m toward the firing point.

The AZ and range limits determined in steps 3 and 6 of Phase II also describe a small area around the target. This is the target selection box. All targets selected from within this box will fall within the safety "T" for the live-fire OPAREA (Figure J-12).

EXHIBIT 4
Carruth Declaration

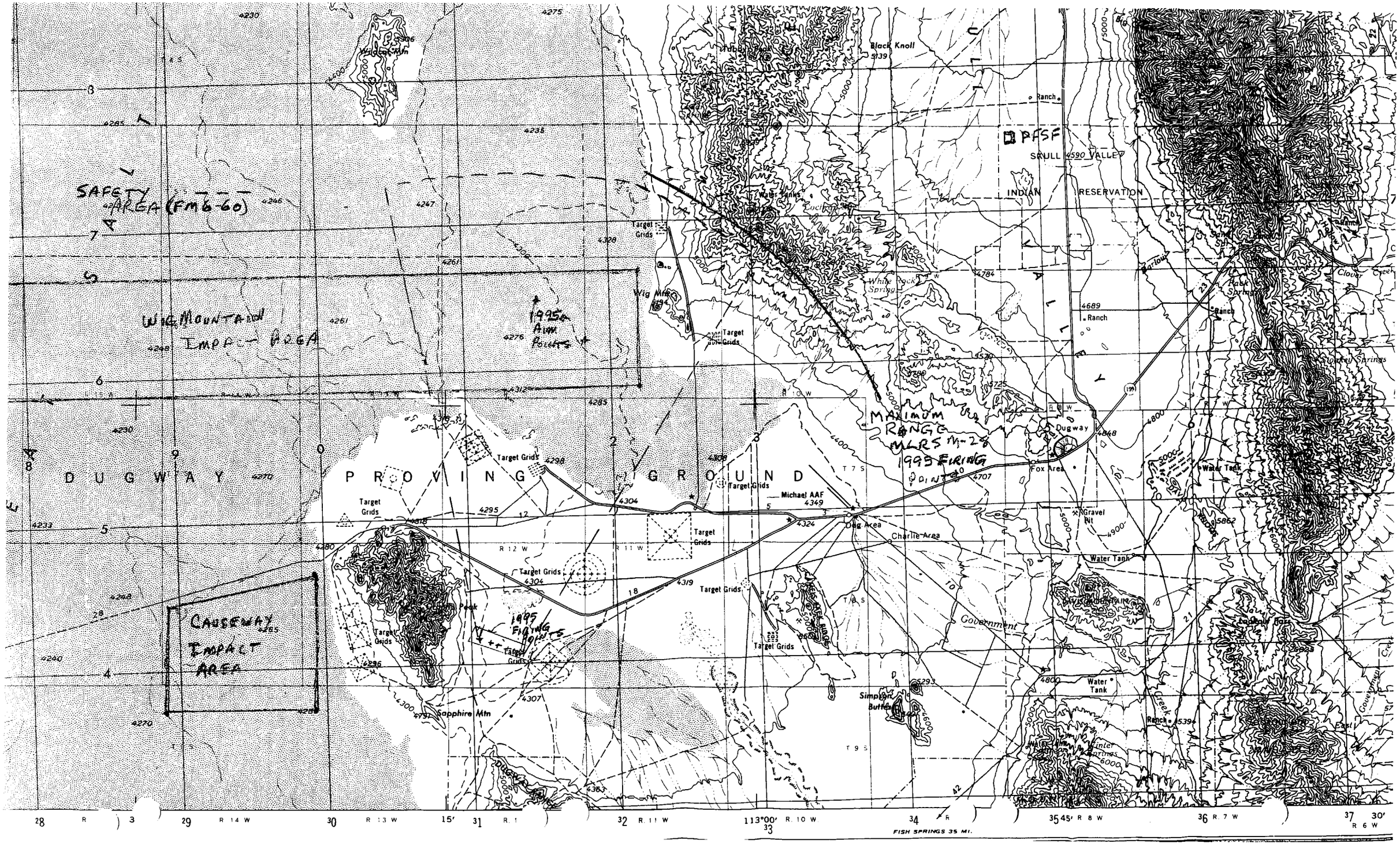

SAFETY AREA (FM6-60)
WIG MOUNTAIN IMPACT AREA
1995 AIM POINTS
DUGWAY PROVING GROUND
CAUSEWAY IMPACT AREA
1995 FIRING POINTS
MAXIMUM RANGE MLRS M-26 1995 FIRING POINTS
PFSF
SKULL VALLEY
INDIAN RESERVATION
Black Knoll
Wig Mtn
Sapphire Mtn
Simpson Butte
Michael AAF
Dugway
Fox Area
Dog Area
Charlie Area
Gravel Pit
Target Grids
Water Tank
Ranch
Government
FISH SPRINGS 35 MI.

EXHIBIT 5
Carruth Declaration

DUGWAY PROVING GROUND

DPGR 350-2

7 JANUARY 1997

RANGES AND TRAINING AREAS

UT-44423

RANGE AND TRAINING AREA REGULATION

CHAPTER 1

GENERAL

1-1. PURPOSE: To prescribe policy and procedures governing control and safe operation of training ranges and maneuver areas at Dugway Proving Ground (DPG), and to implement policies contained in applicable Army regulations and other directives.

1-2. APPLICABILITY: This regulation applies to all military units, organizations and other authorized individuals and agencies that use training ranges and maneuver areas on this installation. Any training or non-test activities are required to comply with this regulation.

1-3. GENERAL POLICIES: DPG contains Test and Evaluation (T&A) Test Grids, test facilities, training areas (TAs), ranges, and facilities for use by Dugway West Desert Test Center for developmental testing of Smokes and Obscurants, Chemical/Biological simulants, and artillery testing. All non test specific training areas and ranges may be made available for Active and Reserve Force units, Reserve Officer Training Corps (ROTC) units/activities, civilian law enforcement organizations/agencies, and other authorized civilian organizations, subject to the following priorities (see 4-11):

a. Research and Development Testing.

b. Military training activities as described in para 4-11.

c. Civilian organizations. Authorized civilian organizations are authorized use of Pistol Range, when available, provided their requests are screened, cleared, and approved by the Chief of Plans and Operations Division (PO) and Safety Office (SA). Additionally, the group must comply with the provisions of this regulation and AR 920-20, Sections II and IV. Civilian organizations using ranges will provide their own material and supplies to include target frames.

d. Small Arm Ranges will be scheduled for organizations. Ranges will not be issued for individual use.

e. Camping in Cedar Mountain Training Area. Camping at Camp Tumbleweed is permitted only if there is no conflict with training. The campsite must be left in as good or better ecological condition than it was prior to occupation. Youth organizations are authorized the use of Camp Tumbleweed provided their requests are approved through P&O; the group has sufficient adult supervision, and complies with all provisions of this regulation.

f. Military organizations must ensure that all personnel are in proper uniform. Tenant activities and training units must conduct training exercises in tactical field uniform. As a minimum, this includes steel/kevlar helmet and LBE. This policy applies to all training facilities and ranges.

1-4. RESPONSIBILITIES: All users of DPG Training Facilities and Ranges must be familiar with this regulation as it is the basis for control of training facilities, ranges, maneuver areas, airspace, and for resolution of conflicts for training activities.

1-5. OFFICER IN CHARGE and RANGE SAFETY OFFICER REQUIREMENTS: Officers-In Charge (OICs) and Range Safety Officers (RSOs) must be Safety Certified and qualified in the training to be conducted (See

UT-44430

Chapter 7).

1-6. MEDICAL REQUIREMENTS:

a. Military training on any DPG live-fire range requires the presence of school trained medical personnel, 91A/B/C; a-dedicated evacuation vehicle and a driver who knows the route to the United States Army Health Clinic (USAHC), DPG. Nonmilitary range or facility users must request military medical support or certify the presence of EMT certified personnel with appropriate equipment.

b. At least two certified EMT personnel with appropriate trauma supplies and equipment and a trauma vehicle must be present during training for the following events or sites:

(1). Live fire tactical maneuver courses and other special firing sites designated by the Range Control Officer (RCO).

(2). Drop zones when used for personnel drops on DPG and drop zones off post for DPG supported personnel.

c. At least one MOS qualified medic, MOS 91A/B/C, with aid bag and a dedicated military evacuation vehicle, with litter and driver, must be present during training at ranges or firing points where high explosive ammunition is being used. This includes, but is not limited to all mortar and field artillery firing points and other special firing sites designated by the RCO.

d. Range Control will notify the USAHC if the need arises for emergency ambulance or medical support.

e. Medical support from DPG for range use is very limited and must be funded by the using unit.

f. All accidents/injuries requiring medical treatment and/or evacuation must be reported to Range Control.

g. Units training at DPG must have medical personnel trained in the first aid procedures for chemical agent casualties (see Appendix K).

1-7. MEDEVAC (DUST OFF):

a. Should an injury or medical emergency occur on a range, the OIC or RSO will call a check-fire, ensure that first aid is begun, and inform Range Control. Control of weapons and ammunition must not be lost during emergency response.

b. If DPG medical personnel are present, they will make the decision, within the parameters established by the Director, Health Services, whether MEDEVAC is indicated or not. They will so inform the OIC or RSO, who will contact Range Control.

c. If the nature of the emergency indicated that a life, sight, or limb threatening emergency exists and medical personnel are not present, the OIC will request MEDEVAC as follows:

(1). Call Range Control on FM 36.10 or telephone 5141.

(2). Inform Range Control that a MEDEVAC is needed. Include the following:

(a). Name of person making request.

(b). Site name/grid coordinates.

(c). Number of patients and nature of injury.

(d). Unit frequency and call sign, if additional unit FM radios are on site.

(e). Hazards to aircraft in the vicinity.

(f). Method of marking the landing zone (smoke, panel, strobe, etc.).

(3). The person recommending MEDEVAC will not break contact with Range Control until released by Range Control.

(4). Range Control will notify the DPG Health Clinic that MEDEVAC is needed and will inform the requesting individual of the status of the MEDEVAC response. The DPG Health Clinic will/will not request MEDEVAC based on the attending physician's analysis of the medical situation.

(5). MEDEVAC frequencies will be initiated on FM 36.10 or VHF 131-10. MEDEVAC will then be moved to frequency being used.

d. If Range Control cannot be contacted, the OIC may make a direct request thru the Dugway Medical Team stationed at the live fire site. If a Dugway Medical Team is not present, then the OIC should call directly to the Dugway Medical Clinic, telephone 2222 or 2211.

e. OICs must keep in mind that weather at DPG occasionally makes MEDEVAC unavailable, and therefore should not delay ground evacuation to health clinic if conditions for helicopter flight are marginal. Should MEDEVAC be unable to respond, DPG Health clinic will transport patient via ambulance to appropriate area hospital.

f. The scene of any injury or property damage accident must be preserved by unit personnel pending investigation by a DPG Investigation Team, the unit commander, and, for accidents involving damage to material greater than $200,000, or a fatality, by a team from the U.S. Army Safety Center at Fort Rucker.

1-8. PERSONNEL SAFETY CERTIFICATION:

a. All live-fire and non firing facility OICs and RSOs must meet requirements outlined in Chapter 4, AR 385-63 and be safety certified. Additional mortar and artillery certification requirements are described in Chapter 8.

b. Certification is accomplished as follows:

(1). The OIC/RSO candidate must read this regulation, with special emphasis on those portions pertaining to range operations. Additional safety restrictions may be directed by subordinate commanders, but will conform to the provisions of this regulation and its references. Unit commanders will ensure that officers and noncommissioned officers detailed as Range Officers/NCO and Safety Officers/NCO are thoroughly qualified.

(2). The unit conducts a program of instruction on the duties of OIC and RSO, and ensures that the candidates are qualified and knowledgeable in the weapons or events involved. All personnel concerned will

UT-44432

become thoroughly familiar with pertinent technical and field manuals regarding care, handling, and safety precautions of the particular weapon and ammunition being fired.

(3). The unit provides a memorandum of certificate of OIC/RSO qualification to P&O and Range Control.

c. Range safety certification is for a period of six months. Personnel involved in accidents or incidents will be suspended from certification during incident investigation.

d. OIC/RSO candidates must receive a Range Briefing from the RCO or Range Control at the time units come to Dugway.

1-9. COMMUNICATIONS:

a. During any live fire exercise, loss of communication with Range Control requires an immediate cease-fire until communication is reestablished.

b. Ground units conducting training anywhere on the DPG Range Complex must have at least two operational means of communication with Range Control and/or Security. Combinations of radios and telephones meet this requirement. Range Controls FM radio frequencies are, 36.10/36.70 in event of emergency. Arrangements for users with no radio communication can be made with P&O or Range Control. Units having their own radio network will be required to provide Range Control with a base station and must comply with paragraph c below. Air units must be able to communicate with DPG Range Control (FM36.10, VHF 131.1, UHF 242-4) and Michael Army Airfield (MAAF) (FM 41-50, VHF 126.2, UHF 241-0).

c. The above radio frequencies are reserved as DPG Installation Range Safety nets. Units with these frequencies in their CEOI must establish and use alternates. All radio frequencies used at DPG must be cleared through MT-TD-I (Instrumentation Office) DSN 789-5412 or (801) 831-5412. Under no circumstances may unit business be conducted on DPG standard Range Control nets.

d. Organizations which plan to conduct operations on DPG must possess adequate communications capability. DPG has minimal communications capability. If, in the opinion of Chief of Plans and Operations, adequate communications capability cannot be obtained, the organization will not be permitted to use Dugway Proving Ground. Contact P&O Range Scheduling Officer for guidance/assistance.

1-10. HELMETS AND HEARING PROTECTION: Military protective headgear must be worn on all live-fire maneuver ranges, all ranges with overhead fire, all ranges or firing points where high explosive ammunition is fired, and during parachute jumps. Helmets may be required on other sites at the commander's discretion. Hearing protection is required on all firing ranges and all other locations where noise levels produced by equipment is excessive (exceeds 85db).

1-11. ALCOHOLIC BEVERAGES: Alcoholic beverages are prohibited on all ranges, training facilities, and training areas.

1-12. AUTHORIZED USE: All parts of the range and training area complex are off limits, day and night, to all units and all personnel, military or civilian, without approved scheduling or use permit. Reconnaissance by military personnel for future training is authorized, but must not interfere with ongoing training, and must be scheduled.

1-13. UNIT CONSTRUCTION: Unit plans for construction of barriers, emplacements or other structures must be noted on Range Request during scheduling. All construction will require a record of environmental consideration

and all digging requires a preapproved excavation permit and/or waiver from Division of Installation Services (DIS). All construction on, or addition to, fixed ranges and facilities must be approved by P&O through DIS.

1-14. PRIVATELY OWNED VEHICLES (POVs): Privately owned vehicles are prohibited on the ranges, on non-firing training facilities, and in training areas. Government vehicles must be outside cantonment areas.

1-15. PUBLIC AFFAIRS (PA):

a. The Commander, DPG, is the approving authority for all media visits and tours to DPG.

b. PAO will evaluate all community requests to use on-post facilities. All such requests will be forwarded to PA, where they will be screened for propriety and conformity with applicable regulations, and coordinated with appropriate Dugway Directorate staff sections.

c. All media members must be under DPG PAO or PM escort while on DPG.

d. Prior concurrence by the Department of the Army must be obtained for visits and tours by national media to the installation.

e. A one week prior notification to DPG PAO will be necessary for visits by local media; two-weeks notification is necessary for national media representatives. Notification will include names, organizations represented, coverage planned and equipment to be used (video/still camera, tape recorder, etc.).

f. Cameras are prohibited beyond Fries Park at DPG and will be confiscated unless an approved camera pass is obtained from the DPG Instrumentation Branch.

1-16. ADJUTANT/PROTOCOL: The DPG Protocol Officer will be provided the following information for units training at DPG.

a. A list of known VIPs in the grade of 06 and above and all state and government officials that will visit training exercises on DPG.

b. Requests for VIP quarters.

c. Requests for all functions for official visitors; i.e., formal/informal luncheons and dinners, etc.

1-17. SPECTATORS:

a. Requests for spectators on ranges or training sites must be coordinated with P&O.

b. Spectators at test or training events must be controlled by the OIC. Personnel must be kept clear of hazardous areas, must be briefed on safety, and must be provided safety and hearing protection, if needed.

c. Spectators on a Firing Range will be IAW AR 385-63, para 4-9.

1-18. MAPS: Maps of the DPG military reservation can be obtained at the DPG Facility Engineering work order desk, Bldg 5474, phone 2214.

1-19. RECOMMENDATIONS FOR CHANGE: Users of the DPG range complex are encouraged to comment on

UT-44434

this regulation. Recommendations for additions, deletions, or other changes should be addressed in writing to Commander, U. S. Army Dugway Proving Ground, ATTN: STEDP-DBO-PO, Dugway, UT 84022-5000.

TABLE 1-1

OFFICER-IN-CHARGE (OIC) AND
RANGE SAFETY OFFICER (RSO) REQUIREMENTS

WEAPON SYSTEM OR DEVICE	OIC(note 1)	RSO(note 1)
Practice hand grenade; practice rifle grenade; subcal training devices; laser ranges; firing devices, simulators; trip flares; small arms; machine guns.	E-6 & Above	E-6 & Above
Chemical training munitions and smoke.	E-5 & Above (note 2)	None Required
Aerial gunnery; air defense weapons; flame throwers; live hand grenades; live rifle grenades; mines and demolitions; mortar; recoilless weapons; rockets.	E-7 & Above	E-6 & Above
Artillery	Officer	E-7 & Above
Live-fire exercises using organic weapons	Officer	E-6 & Above
CALFEX using external fire support (note 3)	Officer	Officer

NOTE 1: Officers-in-Charge and RSOs must be trained and/or qualified on the weapon or device being used and Range Safety Certified. See Chapter 7. Indirect-fire OICs and RSOs must also be Command Safety Certified. See Chapter 8.

NOTE 2: During NBC training, the OIC and RSO must be NBC qualified, either by award of NBC MOS or by graduation from an installation NBC school. Unit commanders must certify OICs and RSOs by memorandum to Range Control, showing name, rank, SSN, and source of qualification.

NOTE 3: OIC will be Field Grade Officer for Battalion or larger size units.

NOTE 4: For activities not listed above, see the facility description in the appropriate Appendix.

THIS PAGE LEFT BLANK

CHAPTER 4

SCHEDULING OF RANGES AND TRAINING AREAS

4-1. General. The use of ranges, training areas, and associated airspace at DPG for any purpose requires the approval of the P&O. All requests to establish training exercises/problems, modify previously approved training exercises/ problems, or to designate tests and special projects will be submitted to P&O. Requests should come through the proper chain of command prior to submission to P&O. The RCO, will coordinate requests through appropriate DPG staff agencies.

4-2. Range Support. Range support will be provided as detailed in Range Requests and other documents as appropriate. Range Control support is required for any training or exercise on DPG ranges or training areas or as specified in Chapter 15. Training units may require Meteorology Data, airfield support (ground support, refueling), billeting (BOQ or NG licensed facilities), mess facilities, or other base operations support. Those support requirements must be specifically addressed in the Range Request. Request for DPG support requires funding which will be accomplished under DOD 4000.19 R and supplements thereto. Transfer of funds for DPG support must be accomplished at least three weeks in advance to ensure the fund cite is established prior to unit arrival. Send DD Form 448 for reimbursable funding to STEDP-DBO-RM-B. Users will fund all labor, supplies, instruments, equipment facilities, utilities, and administrative services required to support their training.

4-3. Dugway Range Management.

a. Ranges and their capabilities are listed in Appendix B. Use of established ranges for weapons or courses of fire not specifically authorized by this regulation is prohibited without prior coordination with and clearance by P&O.

b. Special live-fire exercises on any part of DPG must be coordinated with and approved by the P&O, DEP, and SA. Operations/safety contracts and surface danger zone overlays are required. See Chapter 9 and Appendix E.

4-4. Non Firing Training Facility Management. Training facilities are listed in Appendix C. Occupation, use, and clearance information is contained in Chapter 13.

4-5. Training Area Management.

a. Dugway maneuver training areas use and guidance is described in Appendix D.

b. Direct early coordination between users and P&O for ARTEP and other special land use or training exercises is required.

4-6. Airspace Management. Dugway airspace use is governed by 1 Oct. 87 MOU between DPG and Det 1, 412th TS and Chapter 11. Organizations involved in flight operations must ensure that aviators are aware of local airspace restrictions. See Chapter 11 and Appendix F.

4-7. Planning and Operating Considerations. Personnel responsible for preparing requests for range training facilities, and for programming the exercise/problem must consider the criteria established in pertinent FM/TM, DPGR 350-2, AR 385-62, AR 385-63 and AR 385-64. No portion of the surface danger area for weapons or explosives will intersect or cross the following areas:

a. Test and evaluations facilities.

b. Areas being used for West Desert Test Center (WD) testing.

c. Reservation boundaries.

d. Post ammunition storage area and post ammunition vehicle holding area.

e. Built up areas and the cantonment area.

4-8. Survey Information Center.

a. The Lockheed Survey Information Center (SIC) is responsible for the supervision of all permanently established survey control points on DPG.

b. The positions of all Survey Control Points (SCPs) within DPG will be listed in either the geodetic trig list or the firing point trig list.

c. Standard survey disks or markers emplaced in concrete monuments, bedrock or permanent type structures will be used to mark geodetic and artillery SCPs.

d. Permanently established firing points and orienting stations will be concrete monuments, approximately 10 inches in diameter. A standard survey disc will identify the point over which an instrument must be plumbed. A witness mark will identify the point. Ends of orienting lines will be identified by metal survey quad markers erected over standard control points, or by six foot high black and white poles set in concrete.

e. Quad markers consisting of tall, highly visible metal survey targets will be erected over selected geodetic and artillery fourth order SCPs. Quad markers will not be erected over artillery fifth order control points.

f. New permanent survey control points will be established only with concurrence of P&O.

g. P&O will exercise general staff supervision over all survey control within DPG.

h. The Survey Information Center, operating under Lockheed will:

(1). Staff through using units, a trig publication list of geodetic and artillery SCPs laying within DPG.

(2). Staff through using units, a firing point trig list publications.

(3). Periodically publish changes and additions to the trig list.

(4). Take action on all requests for additional survey control and coordinate the efforts of all agencies concerned.

(5). Maintain liaison with all survey units on post.

(6). Advise units on matters pertaining to survey.

I. Users will immediately notify the RCO if any SCPs or markers are missing or damaged.

UT-44455

CHAPTER 6

IMPACT AREAS

6-1. General.

a. Dugway Proving Ground has three impact areas for training: White Sage, Wig Mountain and Causeway. All impact areas are marked with warning signs, barriers, and/or guards. Passing any of these hazard warnings without Range Control permission is forbidden. Access to White Sage Impact Area must be cleared thru Range Control. Use of the observation point located in the Simpson Butte Area must be cleared thru the RCO. Use of the Wig Mountain and Causeway Impact Areas require unit road guards.

b. All impact areas are hazardous and off limits to all personnel except as coordinated with and cleared by the RCO. Entrance into impact areas requires a DPG EOD Escort.

6-2. Duds. All dud ordnance items are extremely hazardous and must not be disturbed. Any dud found along the boundary of or outside an impact area must be reported to Range Control immediately for evaluation by EOD.

6-3. Impact Requirements.

a. All firing on established ranges and firing points will be conducted to cause bullet or projectile impact in the designated impact area. Impact outside an authorized area will be reported to Range Control immediately.

b. Officers in Charge of special firing courses involving direct, indirect, aerial weapons, or laser devices, must know and identify to their personnel the azimuth or deflection and elevation limits established by approved overlays that will keep weapon, ammunition or device effects within the designated impact area for the course or event.

6-4. Barriers and Guards.

a. Some established ranges and most special firing courses have barrier and guard requirements to restrict entry of nonparticipating personnel into hazard zones. Placement and security of these barriers and guards are the responsibility of the using unit and will be checked by the Range Inspection Team.

b. Barriers may be permanently emplaced gates or temporary barricades provided by the using unit.

c. Unless specifically exempted by Range Control, all hazard area guards placed by a unit must have radio or telephone communications with the range. Roving patrols must have radio contact with the CP and should also carry portable public address sets to aid in announcing firing hazards.

d. Road guards and barricades will not be bypassed without the permission of the range OIC. Barricades must be removed as soon as possible following the conclusion of the mission dictating their use.

6-5. Impact Area Trespass. Anyone observing personnel or vehicles in an impact area must inform Range Control (FM 36.10, telephone 5141) immediately. Range Control will call a check fire and dispatch a Range Inspection Team or Security to investigate.

6-6. Maneuver in Impact Areas.

a. Units desiring to maneuver in or through permanent impact areas must coordinate routes in the initial range

request to P&O.

b. Due to extreme dud hazard, the DPG impact areas will not be scheduled for ground training.

6-7. Explosive Ordnance Disposal Support.

a. US Army Escort and Disposal Unit EOD soldiers provide emergency response to training unit incidents on DPG 24 hours a day.

b. Army EOD must respond and render safe, remove, or dispose of the explosive or chemical hazard. Requests for assistance reported to Range Control or directly to EOD must include the following: A description of item found or problem; incident location; point of contact; phone number or radio call sign and frequency; and a rendezvous point. A guide should be made available to guide the team to the incident location especially during hours of darkness. Misfires or malfunctions involving artillery weapons must be handled IAW procedures in applicable weapon TM prior to requesting EOD support.

c. Army EOD has the capability to respond to USAF aircraft with hung ordnance emergencies. Disposition of downloaded bombs and fuzes should be provided to DPG prior to start of exercise.

d. EOD personnel will respond to dud munitions that are required to be cleared immediately, i.e., duds that are found in maneuver areas or duds that land outside the impact area. Any other duds will be cleared as soon as possible after they occur. Involved forward observers will assist in locating duds. Otherwise, duds will be cleared only from areas specifically designated by the Commander, DPG, after ENDEX.

e. Response time.

(1). When the team is located at the EOD offices, response time to aircraft with in-flight emergencies will be within 5-10 minutes after aircraft touch down at the NW Decon Pad, Michael Army Airfield. Arrival time to the aircraft should not exceed 30 minutes if the EOD team is located elsewhere on DPG.

(2). A team will respond to other EOD incidents within 60 minutes after a request for assistance. Arrival time will vary based on the incident location.

f. EOD personnel will escort visitors into dedicated impact areas IAW AR 385-63. EOD personnel will not enter impact areas during the hours of darkness except in an emergency to save life or property. EOD personnel will not conduct routine demolition operations during the hours of darkness.

g. Units conducting P&O approved target placement for special firing courses will be required to meet the above requirements.

6-8. Impact Area Description. All impact areas are shared with the Test and Evaluation activities at DPG.

a. White Sage Impact Area

Beginning at grid UV 466405, to UV 466340, to UV 410340, to UV 410405, point of beginning. A 1000 meter buffer zone must be drawn inside the above description and that enclosed area will constitute the impact area.

b. Wig Mountain Impact Area

Beginning at grid TV 730675, to TV 730590, to UV 225590, to UV 225675, point of beginning. A 1000

meter buffer zone must be drawn inside the above description and that enclosed area will constitute the impact area.

c. Causeway Impact Area

Beginning at grid TV 880440, to TV880370, to TV990460, to TV99 0370, point of beginning. A 1000 meter buffer zone must be drawn inside the above description and that enclosed area will constitute the impact area.

THIS PAGE LEFT BLANK

CHAPTER 8

INDIRECT FIRE

8-1. General.

a. This chapter discusses use of ranges and facilities for live fire of mortars and field artillery. The intent of this chapter is to provide procedures which are safe, comply with AR 385-63, yet provide the most realistic training environment for commanders. The governing factor is safety. Airspace clearance requires that units request activation of R6402 not less than 30 minutes prior to firing. See Chapter 11. Active firing points and hazard areas are announced in the Weekly Range Schedule (UTTR) and Daily Test/Training Schedule published by Range Control.

b. Personnel in charge of firing mortars or field artillery must be familiar with AR 385-63 and all current changes and supplements thereto.

c. Hearing protection is required for all personnel on active mortar and field artillery firing points.

d. Officers in Charge must ensure that data includes safe range to canister impact before firing illumination rounds.

e. Firing hours are not restricted. Requests for DPG Range Complex will be considered by P&O and, if restrictions on firing hours or trajectory limits are necessary, P&O will notify unit by phone and in range request response.

8-2. Command Safety Certification Program.

a. All units firing field artillery and mortars at DPG must establish and maintain a Command Safety Certification program, IAW Chapter 11 of AR 385-63, for personnel controlling indirect fire exercises. This program must exist at battalion and brigade/Division Artillery level, as a minimum. Certification is required for personnel serving as artillery or mortar OIC or RSO; firing battery commander; battery XO; mortar platoon leader; artillery FDO; artillery chief of firing battery; artillery gunnery sergeant; mortar platoon sergeant; and artillery howitzer section chief. Record of certification of all personnel except OIC/RSO must be maintained at the unit.

b. Unit certification of OIC/RSO must be consolidated on a memorandum, with unit letterhead stationary for non U.S. Army units, to P&O per the example at Figure 8-1. The correspondence must be signed by the battalion or separate battery/company commander and is valid for one year from date unless superseded sooner by the unit. Single entry additions and deletions will not be accepted. Certification of personnel involved in firing incidents must be suspended during incident investigation.

c. Command Safety Certification Programs must be reviewed annually in March by the Installation Safety Office and by P&O. Units firing field artillery or mortars must submit an updated copy of their programs to the Installation Safety Office, STEDP-CM-SA and P&O, STEDP-DBO-PO. Programs must be reviewed and then filed by the RCO. Units without an approved program and certification memorandum or letter on file with the RCO will not fire.

d. Officer in Charge. The OIC will be the appropriate battery commander or his command safety certified representative. The OIC is responsible for all aspects of safety in the firing unit while it is in the training area. The OIC must obtain firing information and limitations from Range Control prior to firing. The OIC or his

representative must compute safety data using firing position/point location and the location of the target area. The number of dog legs required is the option of the OIC. This safety data must include the lateral safety limits, the minimum and maximum ranges, and minimum fuze time/VT ranges. The OIC must supervise the conversion of the safety data into a safety diagram and ensure that this diagram is verified by a separate command safety certified individual. The safety diagram must provide right and left deflection limits, minimum and maximum quadrant elevations, and minimum safe fuze times for all charges to be fired. The safety diagram must be provided, modified as necessary by the executive officer's minimum quadrant elevation, to the appropriate members of the firing battery.

e. Firing Battery Executive Officer is responsible for the safety practices of the firing battery. He is assisted by the Chief of Firing Battery and the Fire Direction Officer/NCO.

f. Assistant Executive Officer/Fire Direction Officer has primary responsibility for computing the safety diagram from the safety data and for ensuring all safety diagrams are updated after registrations and receipt of current meteorological data. He will ensure all firing data are within prescribed safety limits, prior to transmission to the firing battery.

g. Chief of Firing Section (gun/howitzer section chief) is responsible for ensuring that only safe practices take place at or near his weapon, to include verifying that the announced and proper data for quadrant and deflection are applied to his weapon and that the proper charge, fuze, and projectiles are fired. He has the final responsibility for the safe firing of his weapon.

NOTE: The requirement for indirect fire Command Safety Certification is binding on all units 30 days after date of publication of this regulation. The requirement for review of the Safety Certification Program is binding 180 days after date of publication.

8-3. Firing Points.

a. Field artillery and mortar firing points are permanent live fire training facilities established by 4th order survey and listed in the I Corps Artillery Trig List. Artillery firing point monuments are shell cases embedded in concrete. Mortar point monuments are concrete markers. Mortar platoon base pieces must be within 20 meters of the firing point monument. Field artillery pieces must be placed so that the greatest displacement along the gun target line is 500 meters to left or right in width, by 500 meters to front or rear in depth. In order to facilitate tactical realism, and on a case by case basis, the artillery training unit commander may be authorized to establish firing positions anywhere within the defined training areas. Common sense must be used by the commander to protect the environment in the training area. It must be recognized by each using commander that deliberate damage to the environment will result in restrictions being placed on the unit's training. See Chapter 3 for environmental considerations during training. Requirements for the NO Firing Point Concept described above will be as follows:

(1). Establishment of firing point from existing FP.

(2). Calling in coordinate of new firing point to Range Control.

(3). Range Control approval to fire from newly established firing point.

(4). Left and right limits conform to establish training area boundary.

(5). Projectiles fall within established impact area.

(6). That no other firing unit is within surface danger zones (SDZs) A, B, or C.

(7). Safety Fans are established for the established firing points to ensure limits fall within established safety limits.

b. Mortar point OICs or RSOs who have the range assignment must be present on site throughout the period of use. Artillery OICs (usually the battalion S-3 or FDO) may sign for and open a group of firing points to be used by units of the same battalion, and must be with the unit in the field throughout the firing.

8-4. Mortar Firing.

a. Overhead fire by mortars is prohibited. Mortar OICs and RSOs must know the extent of their authorized target area as described in the mortar point SOP, and must ensure that no personnel are located therein or under the trajectory during firing. When plotting boards are used, the target area overlay in the mortar point SOP must be drawn on the board. The overlay must also be drawn on mortar forward observer's maps.

b. The OIC must ensure that all safety and chain of command personnel involved in firing have successfully completed the Command Safety Certification Program.

c. 81mm and 107mm mortars must be laid using either the M2 aiming circle or the M2 compass, as determined by the trainer or by unit equipment availability. However, the lay must always be checked by an independent M2 aiming circle.

d. 60mm mortars must be laid as above unless aiming circles are not authorized by MTOE at battalion level. When aiming circles are not authorized, 60mm mortars will be laid and checked with two M2 compasses. Check readings between compass and mortar sight, and between lay and check compass, must agree within 10 mils. An independent check instrument must be present and in use. There are no exceptions.

e. Officers in Charge will ensure that individual mortars are separated by the distance required in the weapon FM. The bursting radius of the ammunition being fired will be used as a minimum safe distance (MSD) from each hot tube, inside which nonessential personnel are not permitted. All personnel within this MSD during firing must wear military protective headgear (kevlar helmet).

f. Officers in Charge and RSOs must use appropriate mortar FMs, TMs, and TCs in organizing mortar positions and conducting firings.

8-5. Field Artillery Firing.

a. When personnel occupy any part of surface danger area as defined in AR 385-63, Chapter 11, only lots of ammunition and components approved for "overhead fire" must be used. Shell ICM and all mortar ammunition will never be fired over troops.

b. At least one commissioned officer or civilian equivalent must be present on each firing point from which live fire is to be conducted. This officer, usually the Executive Officer, is designated the Position Commander and may also be OIC. The Position Commander performs those duties listed in AR 385-63, Chapter 11. The position RSO must be an E-7 or higher and can have no other duties during firing.

c. Field artillery SDZs are established by AR 385-63, Chapter 11. Hazard Areas A, B, C, D, and E vary dependent on weapon and ammunition fired. Personnel access to Areas, A, B, and C is prohibited. During indirect

fire, personnel not involved with training may occupy Hazard Area D and that portion of Area E greater than 350 meters from the weapon. Only weapon crews and operational personnel involved in the firing may be closer than 350 meters to the weapon. Firing position commanders must ensure that the 350 meter hazard area is kept clear of unauthorized personnel. This may require placing guards on range roads in front of the battery.

NOTE: Personnel from the Range Inspection Team conducting spot checks of firing positions are to be allowed within this restricted portion of Area E; special visitors sponsored by the unit will be admitted by the firing unit chain of command. Weapon crews and operational personnel involved in the firing must wear military protective headgear (kevlar helmets).

d. In order to facilitate training, the lateral and range limits must be determined by the Firing Unit OIC to allow him to pick the most realistic firing position/point within the training area assigned. Dugway Range Control will verify the left and right lateral limits and minimum and maximum limits prior to allowing the unit to commence firing.

e. Computation of Safety Data.

(1). The OIC of firing points or his representative must supervise the preparation of safety data with the firing battery assistant executive officer/fire direction officer (AXO/FDO). This may be done manually or with computer assistance. The AXO/FDO has primary responsibility for the preparation of technical safety data.

(2). In order to compute safety data two elements must be known; the firing position location and the target area. The OIC must provide to the AXO/FDO the location of the firing unit. This regulation provides the location of the authorized target areas. Map spotting is the least acceptable method of determining position location and should be updated with survey data as it becomes available. Using the firing position location and the target area, the AXO/FDO must determine the basic safety diagram as explained in FM 6-50:

(a). Minimum and Maximum Ranges from the firing position to the near and far edges of the target area.

(b). Left and Right Azimuth limits to the target area.

(c). At the option of the OIC, Dog Legs may be added to the Left and Right Limits to increase the area which may be safely fired. In no case will dog legs allow firing outside the authorized target area.

NOTE: The above data must be recorded on a firing chart and/or tactical map in the battery fire direction center. This displays the limits of safe fire.

(3). The AXO/FDO must compute the Minimum and Maximum Ranges for each charge and projectile to be fired during training exercises. This may be done manually or with any authorized fire direction procedure. Site must be computed using the minimum altitude at the maximum range and maximum altitude at the minimum range line. These sites must be added to the corresponding elevations to determine the minimum and maximum quadrants which are safe.

(4). The Left and Right Azimuth limits firing deflections, based on the battery azimuth of lay, will be determined using manual or computer procedures.

(5). Minimum fuze settings will be determined as follows:

(a). Mechanical Time - fuze setting corresponding to the elevation at the minimum range for each charge to be fired.

(b). Variable Time (VT) - fuze setting designed to arm three seconds prior to the time set on the fuze. They may arm as early as 5.5 seconds prior to the time set on the fuze. In order to allow the maximum area in which fuze VT maybe fired, the time of flight to the minimum range line must be determined and 5.5 seconds added. When rounded up to the nearest second, this will be the minimum safe time for fuze VT.

(6). The above information must be converted to a "SAFETY T" for each charge to be fired. The OIC and AXO/FDO must have the data verified by a second command safety certified individual, normally the battery chief, and provide the information to the firing battery. Firing battery personnel who must have the Safety T information will be the battery executive officer, chief of firing battery, gunnery sergeant, and the section chief of all firing guns or howitzers.

(7). FM 6-40 and FM 6-50 provide details in the preparation of the basic safety T and associated data. Safety computations for high angle and shell illuminating, shell smoke (HP and HC) are discussed in FM 6-50, Chapter 12. High Angle Deflection Limits can be modified by adding the maximum drift for the ranges involved to the right deflection limit and the minimum drift to the left deflection limit.

(8). Ultimate responsibility for the preparation and use of the safety data determined above rests with the OIC.

f. Actions during firing:

(1). For cannons using separate loading ammunition, the lanyard must not be attached to the firing mechanism until the designated cannoneer has announced "READY".

(2). For weapons which produce blast over pressure problems with specific charges, special precautions must be taken. Cannoneers displaying shortness of breath or chest discomfort, bleeding from mouth, nose or ears or excessive shakiness directly associated with weapon firing may be suffering from a blast over pressure injury. Medical attention must be sought. See weapons TM for designated firing procedures.

(3). Fuzes:

(a). Alteration of fuzes is prohibited.

(b). Care must be exercised in handling ammunition to protect the point of fuzes from damage.

(c). Fuzes must be screwed down by hand and then firmly seated with the correct fuze wrench. See weapon TM.

(d). Only standard fuzes must be used during training.

(e). Firing without a fuze is prohibited.

(4). Rammed rounds which cannot be fired and which have been removed from the tube will not be rammed again. They must be declared unserviceable and returned to the issuing ASP for disposal. If rounds cannot be moved, notify EOD who will determine if round must be destroyed on site.

(5). Only propellant charges of the type authorized for the round and weapon must be used.

(6). Unused propellant increments must be collected at each gun/howitzer in a metal or wooden covered container at least 25 meters to the rear of each piece and prime mover.

(7). No Smoking forward of the designated powder pit. This includes no smoking in or around the gun/howitzer. This is the section chief's responsibility to enforce.

(8). Registrations must be conducted on points in the center of the target area prior to engaging targets near the target area boundaries.

(9). The burning of unused propellant increments at unit firing positions is PROHIBITED. Unused increments will be transported IAW Chapter 5 for destruction/storage as directed by Dugway Proving Ground personnel.

g. Fire Fighting Requirements. The danger of grass fire is high. Each battery sized unit must maintain a fire fighting reaction group of at least fifteen people to respond if requested by Range Control. Fires in the impact area will not be fought. Fires in the training area or firing position area will be contained by the using unit. Dugway Range Control must be contacted if fires are observed in the training area.

h. Misfires and Malfunctions. Appropriate weapon TMs have information pertaining to the actions required for misfires and malfunctions. Units are responsible to know and follow the procedures for misfires and malfunctions. Assistance from Dugway EOD and QASAS, if required, can be coordinated through Dugway Range Control.

I. Direct Fire of Field Artillery Weapons. The direct fire of Field Artillery is permitted. Care must be taken to ensure that no one is between the gun/howitzer and the target, (i.e., NO OVERHEAD FIRE). The maximum range for Direct Fire is the range corresponding to Elevation 267 for the charge to be fired (see AR 385-63, Chapter 11) and must be a minimum of 850 meters from firing point. The technical manual procedures for direct fire of the weapons system must be followed.

j. When winds exceed 18 knots, shell illumination, white phosphorus, smoke, and all other pyrotechnics or incendiary devices must not be fired without the permission of Range Control. Pyrotechnic or other incendiary devices must not be used where there is a possibility of starting a grass fire or causing damage to equipment or vehicles.

k. All artillery units are required to have an Internal Range Safety and Firing SOP. The SOP must be on site during firing operations.

8-6. Limited Visibility. Mortars and field artillery may not be fired when targets are masked by fog, smoke, or other obscurants, unless an operational impact locating radar is in use.

8-7. Observation. Regardless of visibility, all impacts must be observed visually or by radar. The OIC will not repeat for rounds sensed as lost until firing data and weapon lay are thoroughly checked.

8-8. Firing Point Development.

a. Development of artillery firing points is an installation responsibility carried out by the RCO in coordination with I Corps Artillery. Sufficient firing points will be developed and maintained to support Active and

UT-44487

Reserve Component unit training and evaluation. The I Corps Artillery Trig List is the instrument by which firing point survey data are noted and preserved. A copy of the Trig List will be maintained by I Corps Artillery and the RCO. The Commander, I Corps Artillery will ensure that all changes to the Trig List are provided to the RCO.

b. The Trig List must be reviewed annually by the I Corps Artillery S-3, P&O, and DPG Environmental Programs Office to determine whether firing points must be changed, added, or deleted in light of past and projected training.

c. New firing points, or major alteration to existing firing points, will be developed as follows:

(1). Reserve Component proposals must be submitted through P&O.

(2). The RCO, in coordination with Safety, DIS, and DPG Environmental Programs Office will review and develop the work request for terrain alteration as necessary.

(3). Upon completion of site preparation work, I Corps Artillery must conduct 4th order survey, publish a change to the Trig List, and provide the new safety data to P&O.

8-9. Mortar and Artillery Firing Incidents.

a. Any projectile that lands or bursts outside approved limits, or is suspected to have landed outside limits, must be reported to Range Control (FM 36.10, telephone 5141) immediately, as follows:

(1). Name, unit and location of person making report.

(2). Date, time and location of impact.

(3). Any injury to personnel. If injuries require aerial or ground ambulance evacuation, Range Control will initiate the MEDEVAC immediately, then record the information below.

(4). Number and type of rounds.

(5). Estimated height (air burst).

(6). Whether the crater has been found (ground burst).

NOTE: If a crater is available, the reporting unit/individual must ensure that it is secured and that no evidence is disturbed until the Range Investigation Team arrives.

(7). Equipment damage, if any.

b. Range Control will:

(1). Order check fire of all affected ranges and firing points by broadcasting the command "CHECK FIRE, FREEZE" on the Range Control net (FM 36.10). This command is used only for rounds out of impact.

(2). Initiate MEDEVAC, if needed.

(3). Notify the following (in order):

(a). MEDEVAC (as needed)

(b). Plans and Operations (P&O)

(c). Safety

(d). Firing Unit Headquarters

(e). EOD (as needed)

(f). QASAS

(4). Monitor MEDEVAC (if any) and the investigation, and allow firing units to return to hot status as the incident is isolated in the field. Return to hot status may only be allowed by Range Control after consultation with Safety, QASAS, P&O, and the investigation team.

c. All units on affected ranges and firing points, regardless of location, impact area, or weapons, must cease firing at the command of "CHECK FIRE, FREEZE" from Range Control. Indirect fire weapon OICs and/or Position Commanders must:

(1). Have all weapon crews fall in at the rear of their pieces. "AS IS".

(2). Ensure that all data on all weapons and aiming circles is preserved.

(3). Ensure that all ammunition components and tools remain undisturbed.

(4). Survey conditions on the firing point without disturbing weapons, ammunition, or equipment and prepare to brief the Range Inspection Team and, if necessary, the AR 15-6 investigating officer.

NOTE: Unit personnel must not conduct any checks of data, propellant, fire control instruments, craters or any other aspect of weapons or impact points.

d. The Range Investigation Team and the Unit S-3 must analyze available evidence to isolate the responsible unit or to develop a list of candidates. This investigation must be completed with all dispatch, while ensuring that no items of evidence are lost or overlooked. If the incident caused fatal personnel injury or equipment damage estimated in excess of $200,000, the Range Investigation Team must ensure that all sites are preserved by the Units involved pending arrival of an Army Safety Center Team from Fort Rucker.

e. P&O must receive the initial report of findings from the Range Investigation Team and inform the suspect unit MSC, or DRCS, that an investigation IAW AR 15-6 must be conducted. If multiple units are involved and the Range Investigation Team cannot determine which is responsible for the incident, all MSCs involved must conduct an investigation. The name(s) of the investigating officer(s) must be reported by the MSC to P&O within one hour of notification. The investigating officer must be on site within one hour of notification, and be briefed by the Range Investigation Team and by all concerned unit personnel. A formal report of findings must be forwarded through the MSC chain of command to reach P&O (STEDP-DBO-PO) within 10 calendar days of the incident, with an information copy provided to the Installation Safety Officer (STEDP-CM-SA).

8-10. Handling of Excess Mortar and Artillery Propellant Charge Increments. Excess increments will be disposed of as directed by DPG personnel.

UT-44489

8-11. Medical Support and MEDEVAC.

a. Medical Support. See Chapter 1.

b. MEDEVAC. See Chapter 1. MEDEVAC procedures will be in each firing point packet.

8-12. Declination Station and Survey Information Center. I Corps Artillery and P&O maintain the DPG Trig List and Declination Station.

UNIT LETTERHEAD
(Sample)

MEMORANDUM FOR Commander, U.S. Army Dugway Proving Ground, ATTN: STEDP-DBO-PO, Dugway, Utah 84022-5000

SUBJECT: Unit Safety Certification

1. References:

a. Chapter 4, AR 385-63

b. Chapter 8, DPGR 350-2

2. The following personnel have been trained and tested per the reference and are certified to perform the duties shown:

NAME	RANK	SSN	UNIT	DUTY
WILLIAMS, D.E.	CPT	xxx-xx-xxxx	C/1-140 FA	Firing OIC
BROADSIDE, James	1LT	xxx-xx-xxxx	C/1-222FA	FP Safety Officer
COURAGE, John	SFC	xxx-xx-xxxx	18 SF Gp	DZSO
HARRY, Steve P.	SFC	xxx-xx-xxxx	B/1-145FA	Gunnery Sergeant
PETER, Willie J.	CPT	xxx-xx-xxxx	C/2-222FA	Fire Direction Officer
CHARLIE, Richard	2LT	xxx-xx-xxxx	444 EN Co	Range Safety Officer

3. This certificate is effective for one year from the above date or until superseded.

JOHN P. DOE
LTC, IN
Commanding

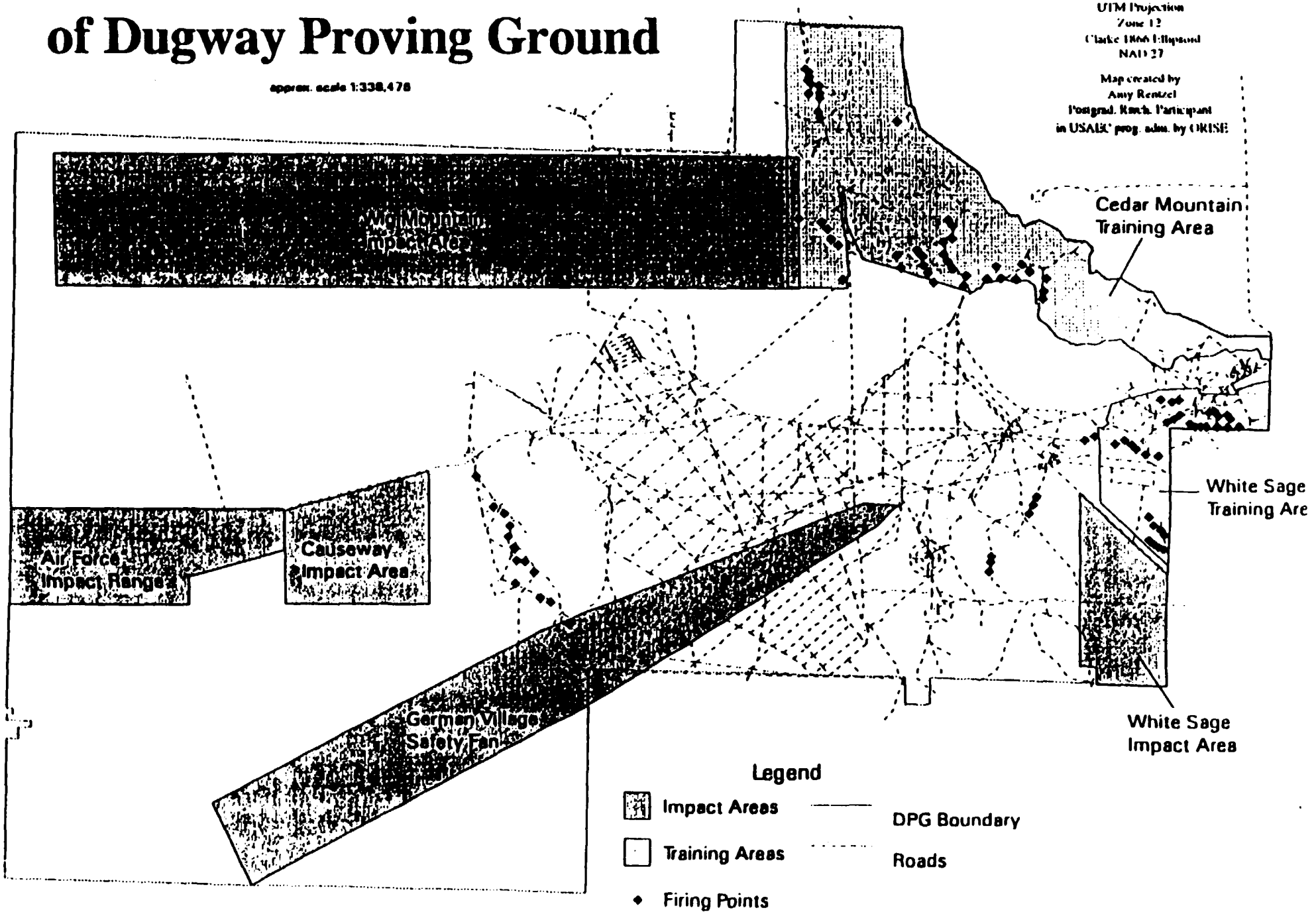
Figure 8-1

Training and Associated Impact Areas of Dugway Proving Ground

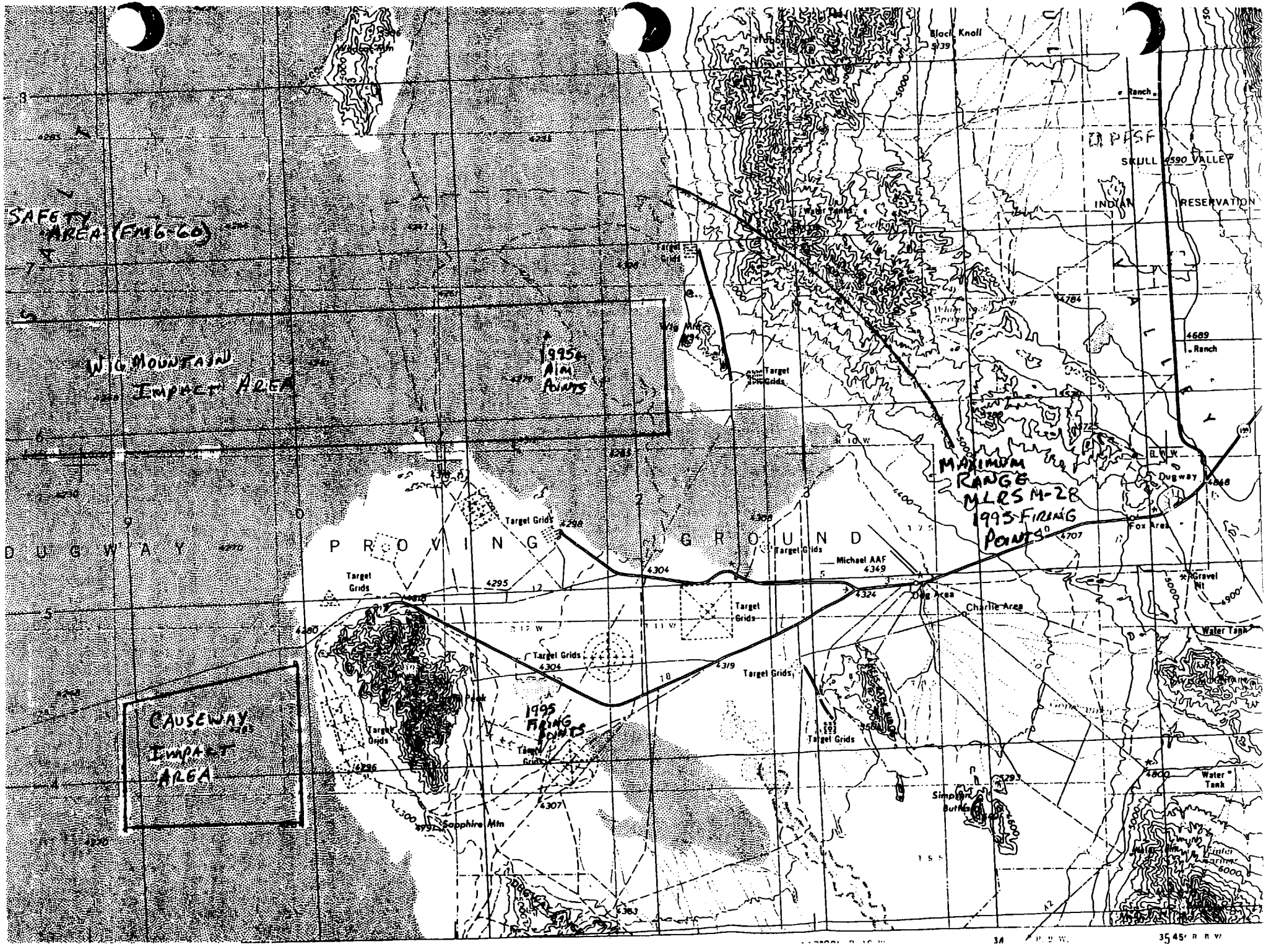
approx. scale 1:338,478

UTM Projection
Zone 12
Clarke 1866 Ellipsoid
NAD 27

Map created by
Amy Rentzel
Postgrad. Rech. Participant
in USAEC prog. adm. by ORISE



UT-44598


SAFETY AREA (FM 6-60)
W.G. MOUNTAIN IMPACT AREA
1995 AIM POINTS
MAXIMUM RANGE MLRS M-28 1993 FIRING POINTS
CAUSEWAY IMPACT AREA
1995 FIRING POINTS
DUGWAY PROVING GROUND
Target Grids
Michael AAF
Dog Area
Charlie Area
Fox Area
Dugway
Gravel Pit
Water Tank
Sapphire Mtn
Simpson Butte
Black Knoll
SKULL VALLEY
INDIAN RESERVATION
Ranch

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	

DECLARATION OF GEORGE WAGNER AND DAVID GIRMAN

George Wagner and David Girman state as follows under penalties of perjury:

I. WITNESSES

A. George F. A. Wagner

1. I am an associate with Burdeshaw Associates, Ltd. In 1998 I retired from the United States Navy with the rank of Rear Admiral after 36 years of service. I am currently the Director of Business Development for the Northrop Grumman Unmanned Systems Integrated Product Team. I am providing this declaration in support of a motion for partial summary disposition of Contention Utah K in the above captioned proceeding to show that potential cruise missile accidents will not pose a hazard to the proposed Private Fuel Storage Facility (PFSF) for the storage of spent nuclear fuel in Skull Valley, Utah.

2. My professional and educational experience is summarized in the curriculum vitae attached as Exhibit 1 to this declaration. I have extensive experience in and knowledge of cruise missile testing and operations. From 1991 to 1995, I was Program Executive Officer for the Cruise Missile programs and Joint Unmanned Aerial Vehicle programs. In that position, I was responsible for 10 major programs, including the Tomahawk cruise missile, the Harpoon anti-ship cruise missile, the Standoff Land Attack Missile, the Tri-Service Standoff Attack Missile, the mission planning systems for

those missiles, all Navy Aerial Target programs, and the design development, procurement, and fielding of all Department of Defense Unmanned Aerial Vehicle systems. In addition, from 1983 to 1987, I was Program Manager for the Ship Launched Tomahawk, during the development, test, and fielding period for the system. I am specifically knowledgeable about the safety of the cruise missile tests that are conducted on the Utah Test and Training Range (UTTR).

B. David Girman

3. I am an associate with Burdeshaw Associates, Ltd. I am currently a Lieutenant Colonel in the U.S. Air Force Reserve and I had 16 years experience on active duty with the Air Force. I am providing this declaration in support of a motion for partial summary disposition of Contention Utah K in the above captioned proceeding to show that potential cruise missile accidents will not pose a hazard to the proposed PFSF for the storage of spent nuclear fuel in Skull Valley, Utah.

4. My professional and educational experience is summarized in the curriculum vitae attached as Exhibit 2 to this declaration. From 1992 to 1995 I was Flight Commander and Chief of Mission Development for the Tri-Service Standoff Attack Missile at Edwards AFB. My responsibilities were to evaluate advanced mission planning systems and to translate tri-service requirements into testable mission planning objectives. I was also a B-52 flight test navigator. From 1989 to 1992 I was Deputy Director of Advanced Cruise Missile (ACM) Operational Test and Evaluation at Edwards AFB and performed operational tests on over 20 flights of the ACM. I was mission commander and flight test navigator for eight flight tests on the UTTR. I was test director and test conductor at UTTR control center for an additional 12 flight tests. I also served as ground commander for the missile recover team. I am specifically knowledgeable about the safety of the cruise missile tests that are conducted on the Utah Test and Training Range (UTTR).

II. CONTENTION UTAH K AND CRUISE MISSILE HAZARDS

A. Introduction

5. In the bases for Contention Utah K, as admitted by the Licensing Board, the State asserts in part that Applicant Private Fuel Storage (PFS) inadequately considered the hazard to the PFSF of credible accidents involving materials or activities at or emanating from, among others, the Utah Test and Training Range (UTTR). We have reviewed information and data concerning the potential hazard to the PFSF from cruise missile testing, which takes place on the UTTR. We have prepared a report documenting our assessment which is attached as Exhibit 3, "Risk Assessment of Cruise Missile Accidents Impacting Private Fuel Storage, L.L.C. Independent Spent Fuel Storage Installation," (Dec. 30, 2000) ("Cruise Missile Report"). Our analysis and the conclusions from our report are summarized below. In sum, because of Air Force measures undertaken to maintain the safety of cruise missile testing and because cruise missiles are not flown in close proximity to the PFSF site, cruise missile testing on the UTTR would not pose a hazard to the PFSF.

B. The PFSF and the UTTR

6. The PFSF site is located in Skull Valley, Utah, approximately 50 miles southwest of Salt Lake City. The site is located over 18 statute miles east of the eastern land boundary of the South Area of the UTTR and 8.5 statute miles northeast of the northeastern boundary of Dugway Proving Ground. The airspace over the UTTR extends somewhat beyond the range's land boundaries and is divided into restricted areas, which are restricted to only military operations, and military operating areas (MOAs). The MOAs on the UTTR are located on the edges of the range, adjacent to the restricted areas. The PFSF site lies within the Sevier B MOA, two statute miles to the east of the edge of restricted airspace. The area covered by the airspace of the UTTR South Area is roughly 148 miles long (at its longest point) by 102 miles wide (at its widest point). The area covered by the airspace of the Sevier B MOA is roughly 145 miles long and, in the vicinity of the PFSF site, is roughly 12 miles wide. Private Fuel Storage, Aircraft Crash

Impact Hazard at the Private Fuel Storage Facility, Revision 4 (Aug. 10, 2000) ("Aircraft Report") at 1, 5, 28.[1]

C. Cruise Missiles

7. Three types of cruise missiles have been tested on the UTTR: Air Launched Cruise Missile (ALCM, AGM-86); Tomahawk (BGM-109); and Advanced Cruise Missile (ACM, AGM -129). All three are subsonic (450-500 knots airspeed), autonomous missiles, which fly carefully pre-programmed flights along designated routes. ALCM and ACM cruise missiles are normally launched at altitudes between 15,000 and 20,000 feet. above ground level (AGL). Then they normally descend to operational altitudes as determined in the preplanned mission profile. Tomahawk cruise missiles are launched from sea and traverse FAA approved Instrument Routes (IR) to reach test ranges located in several places in the United States. Nominal altitudes in flight are usually below 10,000 feet down to 500 feet AGL. The missiles are approximately 21 feet long with wingspans of 8.5-12 feet. The ALCM and ACM are currently tested on the UTTR; Tomahawk was last tested there in 1988.

D. Cruise Missile Test Planning

8. Cruise Missile tests are strictly controlled events, with a comprehensive planning process in place that governs preparation for each test operation. Air Force program offices, operating commands, and test organizations have been directed to employ a disciplined test process throughout all phases of an armament/munitions life cycle. This process applies to all testing including developmental, operational, and combined testing. The cruise missile test process is a consistently applied process intended to reduce risk.[2]

9. The 49th Test Squadron, located at Barksdale Air Force Base, Louisiana, is the responsible test organization for the Air Force Air Combat Command's cruise missile testing program (which is responsible for the testing of the ALCM and the ACM).

---

[1] Submitted with Declaration of James Cole, Wayne Jefferson and Ronald Fly (Dec. 30, 2000).

[2] See Air Force Manual 99-104 Armament/Munitions.

United States Strategic Command at Offutt Air Force Base in Omaha, Nebraska and Air Combat Command at Langley Air Force Base, Virginia have oversight of the cruise missile testing process.

10. Planning typically starts many months in advance of the test, to allow proper preparation and safety review of the test plan.[3] The methodical process includes tasks, with specific responsibilities assigned, for a safe and successful test. The steps in the process include:

- Integration of Objective and Compliance Criteria:
  - Integrate the proposed test objectives to ensure a complete and cohesive set of test requirements.
  - Construct a Test Plan that satisfies all of the objectives, while ensuring that the mission is safe, efficient and economical. Safety is the over-riding concern.
- Mission Planning:
  - Specify the Software and Testing Objectives
  - Specify the Missile Flight Route and Restrictions
  - Plan the Mission
  - Analyze and Validate the Planned Mission to ensure compliance
  - Distribute the Mission Plan for use
- Target Preparation
  - Select target and validate its precise location
  - Develop mission scoring rules
  - Designate support system requirements for monitoring and scoring
- Missile Preparations
  - Designate configuration of missile for flight test
  - Validate the configuration
- Launch Platform Preparations
  - Designate the launch platform configuration for the test
  - Develop specific Test Operations Procedure
  - Train and Certify the launch platform and crew
- Test Operations and Contingency Planning:
  - Detailed Plan of operations for the test
  - Development of actions, procedures, contingency and emergency plans
- Data collection planning
- Mission Firing Plan:
  - Launch Platform procedures

[3] See Tomahawk Test and Evaluation Directive Number 18A, Tomahawk Flight Test Planning.

    - Countdown timelines
    - Go/No Go decision criteria
    - Mission recovery or termination requirements
    - Contingency plan for anomalous events
    - Contingency plans and responses
- Data Distribution Plan
- Mission Scoring Plan
- System Readiness Assessment
    - Ensure all test elements are fully integrated and capable of carrying out the test, including firing unit, range and support assets.

Preparations for each and every cruise missile flight test are intensive and lengthy. Within test missile and funding limitations, the plans are scrutinized throughout their development, with safety always the primary overriding principle, to ensure a successful test.

E. Cruise Missile Test Safety Review

11. Safety and risk reduction initiatives are built into every aspect and phase of cruise missile test operations.[4] The Air Force has a responsibility to protect the public to the maximum extent practicable from the hazards and effects associated with flight operations conducted on their ranges.[5] To this end, a thorough safety review process is in place for weapons testing.

12. The 388th Range Squadron (which is the organization that manages the UTTR) develops cruise missile testing procedures that require operational hazard analysis and formal safety reviews of all test programs as well as safety reviews of particular test missions.[6] The safety review has established the following primary measures to minimize risks:

- Missile preparation
- Aircraft software preparation
- Carrier aircraft preflight inspection
- Missile loading by trained personnel, under supervision, with checklists

---

[4] AFM 99–104 at 7, Fig. 2.2, The Air Force Test and Evaluation Process.

[5] Air Force Instruction 13-201, Air Force Airspace Management, at 27-27, Protection of Civilian Population and Communities.

[6] Air Force Instruction 13-212, UTTR Supplement 1 (TEST), 1 April 1998, at 14.

- Software and missile fault tests
- Missile ejection circuitry analysis
- Real time monitoring of launch circuitry by test personnel
- Routes planned to avoid property and personnel
- Remote Command and Control (RCC) capability to steer missile
- Flight Termination System (FTS)
- Weather minimums ensure chase aircraft can follow missile
- Advanced Range Instrumentation Aircraft (ARIA) relay of telemetry data to Mission Control Center (MCC)
- MCC real-time picture for timely safety decisions
- Remote control system and flight termination system parameters and plans keep missiles in safe areas
- Flight termination system components are independent of missile normal control mode
- Airborne Range Instrumentation Aircraft (ARIA):
- Crew member training on RCC/FTS
- ARIA relay of Telemetry Relay (lets test conductor know if missile is receiving FTS carrier signal)
- Radio relay from Mission Control Center (MCC) to chase aircraft
- FTS signal monitoring (so ARIA crew can warn chase or MCC of hazards)
- ARIA transmits of FTS carrier signal
- Weather criteria
    - Ensure chase aircraft can see missile and ground
    - Ensure chase aircraft can refuel from tankers
    - Criteria for test execution prevent exceeding these limits
- Four chase aircraft required (3 minimum for go)
- Tanker for refueling - required for go
- ARIA aircraft - required for go
- Operational MCC - required to go
- Ground recovery team - required for go
- Helicopter for recovery team required for go
- Contingency procedures to take if elements drop out
- Multiple tracking capabilities to monitor missile flight path at all times

The organization responsible for conducting operational tests of cruise missiles (the 49th Test Squadron) publishes detailed test instructions specifying additional safety criteria, test team membership and duties, and detailed checklists. In addition, they maintain a comprehensive lessons learned program from earlier tests.[7] Between 60 and 45 days before the start of testing, the UTTR Range Control Officer convenes a Safety Review

[7] Air Force Instruction 13-212, Vol. I, Weapons Ranges, Ch. 2, at 14, Ensuring Range Safety.

Board (SRB). The SRB reviews the Operating Hazard Analysis and the approved test plans provided in advance to Range Safety.[8] The organization sponsoring the test must be present at the SRB, and is bound to comply with all range restrictions and the procedures approved by the SRB.

F. Cruise Missile Test Preparation

13. In preparation for each test, routine meetings are held shortly before the execution of the test to ensure that the test can be properly and safely conducted. The program organization responsible for the system reviews and approves the specifics of the mission in a Mission Readiness Review, and the Range approves the accomplishment of the mission on its range as described above. These procedures optimize the launch aircraft and missile configuration, meteorological and atmospheric conditions and generally maximize safety before the missile is launched. As part of the pre-launch process, briefings are conducted, mission readiness is assessed, communication, control and telemetry links are checked, range weather is confirmed, safety concepts are reconfirmed, remote command and flight termination system is checked and verified, air refueling procedures are discussed, air and ground range readiness is confirmed and photo chase requirements are double checked.[9]

14. Contingency operations are also closely reviewed prior to any scheduled cruise missile launch. Mission Control evacuation plans are reviewed. Contingencies for events such as loss of Advanced Range Instrumentation Aircraft (ARIA) UHF radio relay, loss of Remote Command and Control (RCC) are reviewed. Loss of visual contact with missile, loss of chase aircraft, loss of ARIA, loss of tankers, and chase aircraft radio loss are studied. Rigorous application of tested and proven checklists exists for these and other contingencies. Strict protocols derived from lessons learned are applied anytime deviations are noted before, during, and after missile free flights. Rigorous checklist disciplines during unusual situations maximize range safety at all times. In short, extensive measures are taken in preparing for each cruise missile test to ensure that it is conducted safely.

---

[8] AFI 13-212, UTTR Supplement 1, § 3.3.

[9] Advanced Cruise Missile (ACM) Operations Concepts and Procedures, at 24-28.

G. Flight Termination Systems and Missile Impact Locations

15. Under Air Force Instructions pertaining to testing on the UTTR, each cruise missile must have an approved Flight Termination System (FTS) installed so that 1) it can be commanded to alter route or to terminate its flight by a human and 2) it will terminate its flight automatically after failing to receive a designated signal from range aircraft or ground stations for a designated period of time.[10] The FTS must be designed, tested, documented and certified in accordance with Range Commander's Council (RCC) Standard 319-92 or its latest revision and Range Commander's Council Flight Termination Commonality Standard Document 319-99. The UTTR Range Squadron Office also participates in the design and development of FTSs that are used on the UTTR. Under the RCC Flight Termination Commonality Standard Document 319-99, the FTS is required to have a reliability of 99.9 percent at a confidence level of 95 percent.[11] Further, before a bomber launches a test cruise missile, the Mission Control Center verifies that the missile's remote control systems are working properly. The requirement to have an FTS applies to all weapons with the capability of leaving the UTTR; thus the FTS would protect the PFSF from any potential hazard posed by future cruise missiles as well as those currently tested on the range.

16. The Air Force has stated that the UTTR has never experienced an FTS failure on the UTTR.[12] The staff of the 49th Test Squadron, which is responsible for all Air Force cruise missile testing, including that at the UTTR and on other ranges, has recently stated further that it knows of no instance in which an FTS on an Air Force cruise missile has failed.[13]

17. There are two key modes of terminating a cruise missile's flight using the FTS:

---

[10] AFI 13-212, UTTR Supplement 1, § 3.5.2.

[11] Range Commanders Council Flight Termination Commonality Standard Document 319-99 (1999) § 4.4.17.

[12] "Weapons Testing on the UTTR South Range," 388th Fighter Wing, Hill AFB, UT, Response to Freedom of Information Act Request (Dec. 18, 1998).

[13] Meeting with 49th Test Squadron staff (Dec. 8, 2000).

(1) By command from the range when the missile is detected operating improperly, such as deviating from plan, or if a range safety conditions requires terminating the flight. Safety officers can activate the FTS at any time. The Range Safety Officer at Mission Control and the Airborne Range Instrumentation Aircraft are both capable of terminating the cruise missile flight almost instantly.

(2) Loss of the constant carrier signal required to be received from the range or one of the supporting aircraft. At all times throughout the flight the cruise missile FTS must detect a signal that in effect permits the continued flight of the missile. If the missile does not detect the signal for a preset time, the FTS activates, causing the missile to tumble and crash. This arrangement is functionally equivalent to a dead-man switch. This accommodates a missile-losing signal (more importantly loss of telemetry feedback for monitoring the missile's health and status) should the missile reach a "shadow" zone in the flight. By manually terminating the carrier signal, the flight can be terminated in this manner as a secondary means.

In addition to providing flight termination means, the FTS also provides override capabilities to the range and support aircraft to redirect the missile's flight path should that be required. Override control is employed, for example, to remain clear of clouds, to redirect a missile if an anomaly is detected in flight (visually or through telemetry), or in the event the missile needs to be steered clear of unanticipated encroaching aircraft.

18. The distance from a missile's flight path at which it will impact the ground after FTS activation is a function of the missile's speed and altitude and the performance characteristics of the FTS. The ALCM FTS, for example, will cause the missile to impact the ground within at most 0.4 miles of its flight path (cross range or lateral distance) if the missile is flying at or below 5,000 ft. AGL (where the missile typically cruises). If the missile is flying at 20,000 ft. AGL, it will impact the ground within at most 1.05 miles of its flight path.[14] (The maximum distance from its flight path that the missile will impact the ground when flying at an altitude between 5,000 ft. AGL and 20,000 ft. AGL can be estimated by interpolating between 0.4 and 1.05 miles.)[15] In

[14] Boeing Technical Data for AGM-86 Missile at 92, Fig. 3.1-4, attached as Exhibit 4. The distances depicted are conservative in that they assume a 50-knot average velocity wind coming from any (i.e., the most disadvantageous) direction. All distances are calculated from the point at which the command is given to activate the FTS. Actual activation occurs within two seconds of the time the command is given.

[15] See also, e.g., General Dynamics, Convair Division, Tomahawk Sea Launched Cruise Missile System Flight Termination System Report for Land Attack Missile Equipped with Inert or Live Conventional

Footnote continued on next page

addition to FTS activation, a missile can also impact the ground as a result of an in-flight malfunction that causes the missile to lose its ability to fly (e.g., engine failure). Such a malfunction typically causes the missile to impact the ground at a point along the flight path.

19. The practical effect of the installation of FTSs on missiles and the nature of mishaps and impacts that occur without FTS activation is that cruise missiles experiencing mishaps impact the ground very close to their planned flight paths. Col. Craig Lightfoot, Commander of the 388th Fighter Wing at Hill Air Force Base, which is responsible for the operation of the UTTR, has stated that cruise missile impacts on the UTTR have, with possibly one exception (which was not documented), generally occurred within one-half mile of the missiles' flight paths.[16] Col. Lightfoot's statement notwithstanding, the staff of the 49th Test Squadron at Barksdale AFB, which has been responsible for Air Force cruise missile testing for roughly 20 years, has stated that it was aware of no missile impact more than one-quarter of a mile from the missiles' flight paths.[17]

H. Missile Tracking

20. When a cruise missile is flown on the UTTR, it is carefully tracked to monitor the performance of the missile and to enable range officers to take control of or terminate the missile's flight if necessary for safety. The UTTR has the capability to track cruise missiles remotely, both optically and with radar. UTTR ground stations can also receive flight telemetry from and transmit remote control or flight termination instructions to the missile. In addition to ground tracking, the missile test is monitored by an Airborne Range Instrumentation Aircraft (ARIA) in which range officers receive

---

Footnote continued from previous page

Warhead and Range Safety System P/N 3123AS769 U/RGM 109-C (May 1992) at 2-13 (FTS is designed such that in the worst case missile falls to ground less than 2 nm along missile flight path); Tomahawk Flight Test Operations on the West Coast of the United States, Final Environmental Assessment (Oct. 1998), at 2-19 (length of missile impact area (along flight path) is roughly 2.7 times greater than the total width; thus missile can be expected to fall within 0.4 nm of flight path laterally).

[16] NRC Staff, Safety Evaluation Report for the PFSF (Sept. 29, 2000), at 15-98.

[17] Meeting with 49th Test Squadron staff (Dec. 8, 2000).

flight telemetry from the missile, send flight commands to the missile (including potentially a command to terminate the missile's flight) and observe the missile in flight directly. Furthermore, the missile is followed in flight by four to eight chase aircraft that keep the missile in sight at all times. If the chase aircraft pilots detect an anomaly, they can alert the ARIA so that the missile can be flown manually or its flight can be terminated.

I. Cruise Missile Flight Paths on the UTTR

21. Cruise missile launches are generally confined to the northern and western portions of the UTTR and are at least 30 statute miles away from the PFSF site. Approaches by aircraft carrying cruise missiles to the points where the missiles are released are normally done from north to south or east to west and are thus directed away from the PFSF site. Cruise missile targets on the UTTR are all located over 18 miles from the PFSF. These are depicted as TS-1, TS-2, TS-3 and TS-4 in Cruise Missile Report at 11.

22. Furthermore, the Air Force imposes limitations on where cruise missiles may be flown on the UTTR to avoid risk to manned or inhabited locations. The 49th Test Squadron uses a minimum separation distance of 2 nm between missile flight paths and inhabited locations on the UTTR.[18] There are currently 17 such locations, mostly ranches, within Skull Valley itself where this separation is in effect.[19] The Air Force Instructions for the UTTR require further that cruise missile flight paths avoid inhabited areas by a distance of at least 1 nm for flights below 6,000 ft. AGL and a distance equal to the missile altitude (up to 3 nm) for flights above 6,000 ft. AGL.[20] The UTTR also requires that missile flight paths be plotted to approach no closer than within three nautical miles of the outer edge of UTTR airspace.[21] Because of the general presence of

[18] Accident Investigation Board Report, United States Air Force AGM-129 Advanced Cruise Missile, Serial Number 90-0061, 10 December 1997, Dugway Proving Ground, Utah, at 11.

[19] The restrictions in Skull Valley were imposed in the last two to three years. Meeting with 49th Test Squadron staff (Dec. 8, 2000).

[20] AFI 13-212, UTTR Supplement 1, § 2.9.2.

[21] Interview with Boe Hadley, UTTR Range Control Officer.

inhabited locations in Skull Valley (north of 40 deg., 13 min. north latitude), the UTTR has imposed a floor of 1,000 ft. AGL, below which aircraft and cruise missiles may not fly.[22] Finally, because of the presence of manned/inhabited locations, Army chemical and biological laboratories, Michael Army Airfield, and Army artillery training ranges, the Air Force also excludes cruise missiles from flying in a region on the east side of Dugway Proving Ground.[23]

23. The restricted areas around manned locations on the UTTR are depicted as circles and the restriction around Dugway is depicted as an inverted "doghouse"-shaped, cross-hatched region on the map attached to this declaration as Exhibit 5. The practical effect of the restrictions the Air Force has imposed on cruise missile flights on the UTTR is that cruise missiles do not fly in Skull Valley. According to the 49th Test Squadron, because of the restrictions in Skull Valley and on Dugway Proving Ground, the performance of the cruise missiles with respect to the radii of their turns, and the locations of the cruise missile targets on the UTTR, cruise missile flights are not plotted to pass within 10 nautical miles of the PFSF site.[24]

J. History of Cruise Missile Testing on the UTTR

24. There have been 13 documented cruise missile crashes at the UTTR in the last 10 years out of approximately 80 tests. Cruise Missile Report, Table 1. Nine crashes involved Air Launched Cruise Missiles (ALCM), and four involved Advanced Cruise Missiles (ACM), out of a total of roughly 80 ALCM/ACM flights, for a failure rate of roughly 16 percent.[25] As of October 1998, four Tomahawks had failed during cruise flight out of 197 flight tests conducted throughout the world, for an in-cruise failure rate of two percent.[26]

---

[22] AFI 13-212, UTTR Supplement 1, at 12, Flight Avoidance Areas Table.

[23] Meeting with 49th Test Squadron staff (Dec. 8, 2000).

[24] Id.; see also Response to Freedom of Information Act Request from Hill AFB, UT, Public Affairs (Nov. 17, 2000).

[25] Response to Freedom of Information Act Request from Hill AFB, UT, Public Affairs (Nov. 17, 2000).

[26] Tomahawk Fight Test Operations on the West Coast of the United States, Final Environmental Assessment, October, 1998. In-cruise failure rates are much lower than overall failure rates because they do not include instances where the missile fails to fly because of, e.g., engine failure at launch.

25. The locations of the cruise missile crash sites on the UTTR over the last 10 years are listed on Table 1 in the Cruise Missile Report. None of the missiles crashed within 10 nautical miles of the PFSF site. The closest crash location is 18 miles to the west. The remainder impacted over 30 miles from the PFSF, with the most distant 115 miles to the southwest. Assuming a nominal missile ground speed of 420 knots, the nearest cruise missile impact location was at least 2 ½ minutes flying time from the PFSF site. This is a long time considering that an FTS can be activated nearly instantaneously. As discussed above, according to Col. Lightfoot at the UTTR and the 49th Test Squadron at Barksdale AFB, the cruise missile crashes on the UTTR impacted the ground within at most half a mile of the planned missile flight path.

26. Current Air Force test plans call for approximately six cruise missile tests annually. These tests are intended to confirm the continuing viability of the ALCM and ACM missiles currently in the USAF inventory. The flight characteristics of these missiles are well documented. Both the Advanced Cruise Missile (ACM) and the Air Launched Cruise Missile (ALCM) have been in the active inventory since the early 1990s. While Tomahawk cruise missiles have been tested at UTTR in the past, no flights are scheduled for the UTTR in the future.

K. Conclusion

27. Cruise missile testing will pose no hazard to the PFSF. Because of the extensive efforts the military services and the UTTR undertake to ensure the safety of cruise missile tests and the fact that cruise missiles are not flown closer than within 10 miles of the PFSF site, cruise missile testing would pose no hazard to the PFSF. In the event that an anomaly did occur during a test and a missile were to threaten to depart from its planned flight path, the flight of the missile would be terminated by the FTS and the missile would impact the ground far short of the PFSF site. It is not credible that a cruise missile tested on the UTTR would impact the PFSF.

We declare under penalties of perjury that the foregoing is true and correct.

Executed on December 29 2000.

George F. A. Wagner

David Girman

We declare under penalties of perjury that the foregoing is true and correct.

Executed on December 30, 2000.

George F. A. Wagner

David Girman

David Girman

January 2, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

CORRECTION TO DECLARATION OF
GEORGE WAGNER AND DAVID GIRMAN

Applicant Private Fuel Storage, L.L.C. ("Applicant") hereby files a correction to the Declaration of George Wagner and David Girman (Dec. 30, 2000), which was filed in support of Applicant's Motion for Summary Disposition of Utah Contention K and Confederated Tribes Contention B (Dec. 30, 2000). Paragraph 25 of the declaration should be corrected as follows, with new text underlined and old text struck through:

25. The locations of the cruise missile crash sites on the UTTR over the last 10 years are listed on Table 1 in the Cruise Missile Report. None of the missiles crashed within 10 nautical miles of the PFSF site. The closest crash location is 1~~8~~3 miles to the southwest. Another crashed 18 miles from the site and the remainder impacted over 30 miles from the PFSF, with the most distant 115 miles to the southwest. Assuming a nominal missile ground speed of 420 knots, the nearest cruise missile impact location was almost ~~at least~~ 2 ½ minutes flying time from the PFSF site. This is a long time considering that an FTS can be activated nearly instantaneously. As discussed above, according to Col. Lightfoot at the UTTR and the 49th Test Squadron at Barksdale AFB, the cruise missile crashes on the UTTR impacted the ground within at most half a mile of the planned missile flight path.

Respectfully submitted,

Jay E. Silberg
Ernest L. Blake, Jr.
Paul A. Gaukler
D. Sean Barnett
SHAW PITTMAN
2300 N Street, N.W.
Washington, DC 20037
(202) 663-8000
Counsel for Private Fuel Storage L.L.C.

Dated: January 2, 2001

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI

CERTIFICATE OF SERVICE

I hereby certify that copies of Correction to Declaration of George Wagner and David Girman were served on the persons listed below (unless otherwise noted) by e-mail, with conforming copies by hand delivery (where noted) and overnight delivery (otherwise), this 2nd day of January 2001.

G. Paul Bollwerk III, Esq., Chairman†
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: GPB@nrc.gov

Dr. Jerry R. Kline†
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: JRK2@nrc.gov; kjerry@erols.com

Dr. Peter S. Lam†
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: PSL@nrc.gov

* Susan F. Shankman
Deputy Director, Licensing & Inspection
Directorate, Spent Fuel Project Office
Office of Nuclear Material Safety & Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Office of the Secretary†
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Rulemakings and Adjudications Staff
e-mail: hearingdocket@nrc.gov
(Original and two copies)

* Adjudicatory File
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Catherine L. Marco, Esq.†
Sherwin E. Turk, Esq.†
Office of the General Counsel
Mail Stop O-15 B18
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
e-mail: pfscase@nrc.gov

Denise Chancellor, Esq.
Assistant Attorney General
Utah Attorney General's Office
160 East 300 South, 5th Floor
P.O. Box 140873
Salt Lake City, Utah 84114-0873
e-mail: dchancel@state.UT.US

John Paul Kennedy, Sr., Esq.
Confederated Tribes of the Goshute Reservation and David Pete
1385 Yale Avenue
Salt Lake City, Utah 84105
e-mail: john@kennedys.org

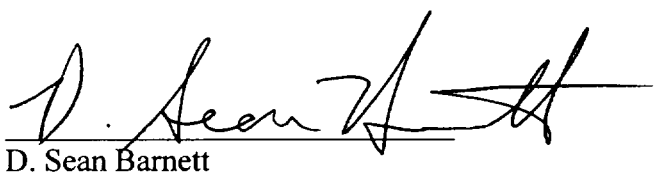
Joro Walker, Esq.
Land and Water Fund of the Rockies
2056 East 3300 South, Suite 1
Salt Lake City, UT 84109
e-mail: joro61@inconnect.com

Diane Curran, Esq.
Harmon, Curran, Spielberg & Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
e-mail: DCurran.HCSE@zzapp.org

Danny Quintana, Esq.
Skull Valley Band of Goshute Indians
Danny Quintana & Associates, P.C.
68 South Main Street, Suite 600
Salt Lake City, Utah 84101
e-mail: quintana@xmission.com

Richard E. Condit, Esq.
Land and Water Fund of the Rockies
2260 Baseline Road, Suite 200
Boulder, CO 80302

* By overnight delivery only
† By hand delivery



D. Sean Barnett

Document #: 1059770 v.1

EXHIBIT 1
Wagner/Girman Declaration

Resume of

RADM George F.A. Wagner, USN (Ret.)

RADM George F. A. Wagner, USN (Ret.)

Rear Admiral George Wagner retired from active duty in 1998 after 38 years of service in the Navy as a Surface Warfare Officer and acquisition professional. He served at sea up through command of a SPRUANCE class ASW destroyer and ashore in several major acquisition program positions during eighteen years of duty in Washington, DC.

His specialties are C^4, ISR, cruise missiles, unmanned aerial vehicles, and command and control systems at the tactical and strategic levels.

Admiral Wagner's last assignment from 1995 to 1998 was as Commander of the Space and Naval Warfare Systems Command (SPAWAR), an organization of 7,000 people with an annual budget of about $3.0B. In this position, he was responsible for the design, development, procurement, installation and support of the Navy's command, control and communications systems, the information technology infrastructure, space based systems, undersea surveillance systems, and force level systems engineering. He also successfully relocated the 1,000 person SPAWAR Headquarters from Washington, DC to San Diego, CA, as part of Base Realignment and Closure (BRAC-95) during this tour of duty.

From 1991 to 1995, he was Program Executive Officer for the Cruise Missile programs and Joint Unmanned Aerial Vehicles programs. As PEO (CU), he was responsible for ten major programs, including the TOMAHAWK cruise missile, Harpoon anti-ship cruise missile, Standoff Land Attack Missile (SLAM), Tri-Service Standoff Attack Missile (TSSAM), the mission planning systems for these cruise missiles, all Navy Aerial Target programs, and the design, development, procurement and fielding of all DoD Unmanned Aerial Vehicle (UAV) systems.

From 1990 to 1991, Admiral Wagner was the Force Warfare Systems Engineer for the Navy, responsible for developing force and theater level technical and interface standards to ensure interoperability of Navy, joint and allied systems. This followed a brief assignment as a Manager and Director of the Navy's Acquisition Professional Personnel program.

From 1987 to 1989, he served as the Assistant Chief of Naval Research with management responsibilities for the Navy's 6.1 and 6.2 Tech Base programs.

Admiral Wagner was the Ship Launched TOMAHAWK Program Manager from 1983 to 1987 during the crucial development, test and fielding period for this then new system. As Program Manager he fielded the first Navy nuclear weapon system in twenty years, TOMAHAWK Land Attack Missile, Nuclear (TLAM/N), the anti-ship version of TOMAHAWK with a radar seeker, and the conventional TLAM which has been used several times this decade in Iraq.

Earlier tours of duty included engineering officer afloat, and maintenance, repair and overhaul coordinator for a Type Commander, with additional responsibility for all new ship construction and conversion programs.

Education: B.Sc., U.S. Naval Academy
M.S., Naval Architecture/Marine Engineering, Massachusetts Institute of Technology

EXHIBIT 2
Wagner/Girman Declaration

DAVID N. GIRMAN

15 MAPLECREST DRIVE
ZELIENOPLE PA 16063

HOME PHONE: (724) 452-5022
WORK PHONE: (412) 474-8155 DSN 277-8155

SUMMARY OF SKILLS

C-130H Navigator, Plans and executes worldwide priority airlift missions. Responsible for navigation, airdrop, tactics and aircraft self-protection considerations. Has 6 years of experience in Operational Test and Development. Directed classified 40-person test team at Edwards AFB, CA for 3 years. Helped develop Air Force Mission Support System (AFMSS) for cruise missile mission planning. Possesses Top Secret SBI and SCI clearance. Familiar with all aspects of digital imagery collection, production and dissemination. Has 10 years instructor experience.

EXPERIENCE

Feb 1995 to present: 180 days per year: Air Force Reserve Command C-130H navigator; 758th Airlift Squadron/DON, 911th Airlift Wing, Pittsburgh IAP ARS, 1240 Sergeants Way, Coraopolis, PA 15108-4412; Lt Col Joseph Poznik (412) 474-8155, DSN: 277-8155. August 1995 to August 1998: Student; Sewickley Valley Hospital School of Nursing; 720 Blackburn Road, Sewickley PA 15143; Mrs. Donna Wadding (412) 741-7300

Aug 1992 to Feb 1995: Flight Commander & Chief of Mission Development for Tri-Service Standoff Attack Missile (TSSAM) Edwards AFB, CA. Commander of 41 – person Air Combat Command (ACC) detachment. Fully qualified B-52 flight test navigator. Additional responsibility is for mission planning cell supporting $16 billion AFOTEC test effort. Evaluates four distinct, advanced mission-planning systems valued in excess of $60 million. Translates tri-service requirements into testable mission planning objectives.

Aug 89 – Aug Advanced Cruise Missile (ACM) Operational Test & Evaluation (OT &E) Deputy Director Edwards AFB, CA. Deputy director for 33 person OT & E team. Performed test director, conductor, and flight test navigator duties on 20 + ACM live and captive carry launches. Organized and initiated beddown effort at first operational ACM base.

EDUCATION

Bachelor of Science, 1977, Case Western Reserve University, Cleveland, OH, Health Science
Master of Public Administration, 1991, Golden Gate University, San Francisco CA, Administrative Organization and Management
Registered Nurse Diploma, 1998, Sewickley Valley Hospital School of Nursing, Sewickley PA

DAVID N. GIRMAN

AWARDS and DECORATIONS

Meritorious Service Medal with one Oak Leaf Cluster
Aerial Achievement Medal
Air Force Commendation Medal
Armed Forces Expeditionary Medal
Combat Readiness Medals
Southwest Asia Campaign Medal

OTHER ACCOMPLISHMENTS

Distinguished Graduate Officer Training School, 1979, Lackland AFB TX
Outstanding Graduate B-52 Combat Crew Training School, 1980, Castle AFB CA

SPECIALIZED TRAINING

Squadron Officer School, 1985 (Residence and Correspondence)
Air Command and Staff College, 1987 (Seminar)
Strategic Air Command Central Flight Instructor Course, Castle AFB CA. 1985
AC-130U Gunship Sensor Operator Course, Hurlburt Field FL, 1987
Nuclear Weapons Instructor Course, Kirkland AFB NM, 1990
Acquisition Management Course, Edwards AFB CA, 1992
Test and Evaluation Management Course, Edwards AFB CA. 1992
Advanced Airlift Tactics Training Course, St Joseph ANGB MO, 1998

LICENSES/CERTIFICATES

Professional Nurse; Pennsylvania License # RN-524098-L; Expiration Date: 31 Oct 2000

CAMPAIGNS

Joint Task Force-Southwest Asia; Operation Southern Watch (Mar-Jun 94) Chief of Combat Operations
Joint Endeavor (Mar-Apr 96)
Coronet Oak (Sep 97, Dec 98, and Mar 99)
Operation Southern Watch (Jun-Jul 98)
Venture Buckeye; Szolnoc, Hungary (Aug 98)
Shining Hope (Apr and May 99)

EXHIBIT 3
Wagner/Girman Declaration

RISK ASSESSMENT

OF

CRUISE MISSILE ACCIDENTS

IMPACTING

PRIVATE FUEL STORAGE LLC

INDEPENDENT SPENT FUEL

STORAGE INSTALLATION

David N. Girman
Lt Colonel, USAF Reserve
George F. A. Wagner
Rear Admiral, USN (Ret)
Associates
Burdeshaw Associates, Ltd.

INDEX

	Page
LIST OF REFERENCES	3
INTRODUCTION:	4
I The Utah Test and Training Range (UTTR) - Brief History - Layout of the Range and Geographic Items of Interest -Range Capabilities - Boundaries - Controlled Airspace Regions - Target Areas - Air Access - Ground Access	8
II Cruise Missile Test Planning - Planning Process - Test Execution	19
III Cruise Missile Test Safety Review - Review Process - Approval Process	22
IV Cruise Missile Test Execution	24
V Flight Termination Systems (FTS) and Procedures - FTS Requirements - FTS Approval/Certification - FTS Procedures and Operation - Command and Control During Testing	29
VI Cruise Missile System Testing at UTTR - History - Range Safety	32
SUMMARY and CONCLUSION	36
DEFINITIONS	37

REFERENCES:

A Technical Order (TO) 1B-52H-30-1 Aircrew Weapon Delivery Manual for AGM-129 Missiles

B. TO 1B-52H-30-4 Aircrew Weapon Delivery Manual for AGM-86 Missiles

C. Accident Investigation Board Report, United States Air Force AGM-129 Advanced Cruise Missile Serial Number 90-0061, 10 December 1997 Volume I of II

D. Tomahawk Flight Operations on the West Coast of the United States, Final Environmental Assessment

E. AFI 13-212 UTTR Supplement 1 (TEST), 1 April 1998

F. Air Force Manual 99-104 Armament/Munitions Test Process

G. AFI 13-212 Volume 1 Weapons Ranges

H. Tomahawk Test and Evaluation Directive Number 18A, Tomahawk Flight Test Planning

I. AFI 13-201 Air Force Airspace Management

J. Range Commanders Council Flight Termination Commonality Standard Document 319-99

K. GNC 02, JNC 043, TPC F16C and G18B, and JOG NK1210 Aeronautical Charts

L. Enroute High Altitude Enroute Chart H-3 and H-2

M. Enroute Low Altitude Enroute Chart L-7

N. Flip Military Route Planning Chart

O. General Dynamics Convair Division Advance Cruise Missile (ACM) Subsystem Familiarization Guide

P. Tomahawk Sea Launched Cruise Missile System Flight Termination System Report No. GDC-AUR-90-119

Q. Paper: Tomahawk Cruise Missile Testing on the Western Ranges

R. Response To Nuclear Waste Freedom Of Information Request (FOIA) from Hill AFB, UT Public Affairs Office

S. Advanced Cruise Missile (ACM) Operations Concepts and Procedures

T. Interview with Mr. Boe Hadley, Cruise Missile Senior Range Control Officer At Hill AFB, UT

U. Memo for Record Site Visit at 49th TESTS Squadron, Barksdale AFB, LA

INTRODUCTION

A commercially operated Independent Spent (Nuclear) Fuel and Storage Installation (ISFSI) is being established in the vicinity of the Utah Test and Training Range (UTTR). The land under the proposed storage is located on the Skull Valley Band of the Goshute Reservation.

The UTTR is utilized for testing of Department of Defense weapons system, including cruise missile, and there is concern for the hazard these missiles may pose to the ISFSI. This report addresses cruise missile testing on UTTR and addresses the risk to the ISFSI.

Any risk assessment of missile accidents impacting the proposed ISFSI, located at 40 24'50"N and 112 47'37"W, involves multiple aspects and many phases of flight operations and aerial maneuvers. This assessment examines cruise missile testing operations and activities in the area to determine the risk posed by cruise missile testing to the facility. Missile operations, routes and procedures are carefully examined and assessed to insure every possible aspect and angle is thoroughly covered.

Three types of cruise missiles have been flown in test flights on the UTTR: Air Launched Cruise Missile (ALCM, AGM-86), Tomahawk (BGM-109), and Advance Cruise Missile (ACM, AGM -129). All three are subsonic, autonomous missiles, which fly carefully pre-programmed flights along designated routes. Cruise missiles are normally launched at altitudes between 15,000 and 20,000 feet. Then they normally descend to operational altitudes as determined in the planned mission profile. Nominal enroute altitudes are usually below 10,000 feet down to 500 feet above ground level. Physical characteristics are:

	ALCM- AGM-86	Tomahawk BGM-109[1]	ACM - AGM - 129
Length	20' 9"	20' 6" (with booster)	20' 10"
Wing Span	12' 0"	8' 9"	10' 2.8"
Diameter	27 inches	20.4 inches	29.25"
Weight: Full	3,200 lbs.	2,300 lbs.	3,300 lbs.
Mission end	1,500 lbs.	1,500 lbs.	1,500 lbs.
Warhead: Diameter	23 inches	20"	24"
Weight	700 lbs.	1,000 lbs.	700 lbs.
Engine: Diameter	14"	12"	14"
Weight	210 lbs.	150 lbs.	210 lbs.
Speed	500 knots	450 knots	500 knots
Range	1,500 NM	1,000 NM	1,800+ NM

This risk assessment will be confined to determining the likelihood or probability of a missile accident impacting the proposed Independent Spent (Nuclear) Fuel Storage

[1] Tomahawk Flight Test Operations on the West Coast of the United States, page 2.2, Table 2-1

Installation (ISFSI). Any evaluation of crash impact effects on the proposed facility is beyond the scope of this assessment.

THE AGM 86 B MISSILE DESCRIPTION (Air Launched Cruise Missile or ALCM)

The AGM-86 is a first generation, subsonic, turbofan powered, winged missile. The ALCM will deliver a warhead in an air-to-ground mission with a high degree of accuracy at long range. During captive carry (see Definitions) the missile is hung on a B-52 wing pylon or carried in an internal bomb bay on a rotary launcher. During captive carry the missile's flight surfaces (wings, fin and elevon) and engine inlet are carried in a stowed position. After launch the missile's flight control surfaces are deployed and the engine provides thrust within a few seconds. Computer controlled navigation directs the missile to its target. The ALCM can carry both nuclear and conventional payloads (although it is never tested with a nuclear payload).

Figure 1: Air Launched Cruise Missile Schematic

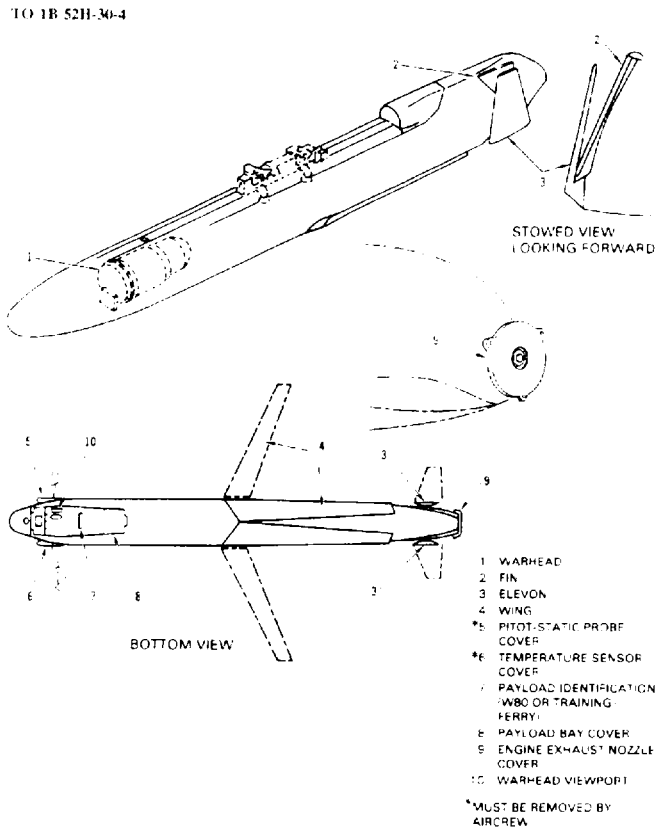


Figure 1-2 Missile General Arrangement

1-4

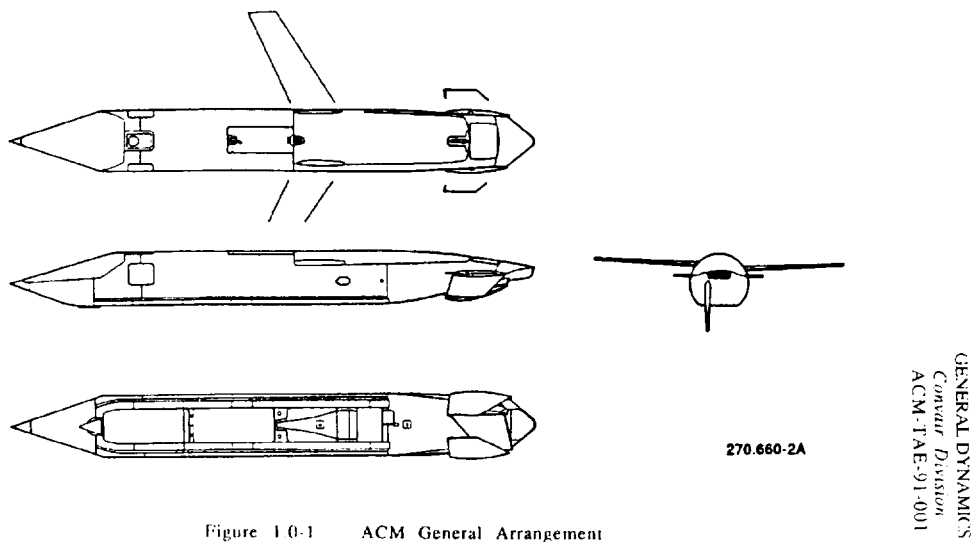
THE TOMAHAWK BGM-109 MISSILE DESCRIPTION

The Tomahawk Cruise Missile system was developed during the 70's to provide long-range standoff weaponry to the U.S. Navy. The system reached its Initial Operating Capability (IOC) in 1984 with deployment of the nuclear variant TOMAHAWK Land Attack Missile (TLAM/N). The Tomahawk Land Attack Missile with conventional warhead (TLAM/C) and a sub-munitions dispense variant (TLAM/D) followed. TLAM is launched from surface ships or submarines against land targets. The missile flies autonomously at subsonic speed along a pre-planned route for the entire mission, which is loaded into the missile as part of the launch sequence. Navigation accuracy is maintained through use of digital maps stored in the missile as part of the data load for the particular mission, using on-board sensors and a very accurate inertial measuring unit (IMU), now supplemented by Global Positioning System (GPS). Test flights of Tomahawk were flown to UTTR in the past, but none within the past decade. See Reference Q for additional information.

THE AGM 129 MISILE DESCRIPTION (Advanced Cruise Missile or ACM)

The AGM 129 is a second generation, subsonic turbofan powered, winged missile. It is an improved version of the AGM- 86 with improved stealth, greater range and forward swept wings. The ACM can only be carried on B-52 external pylons. Other design and mission features are similar to the ALCM.*

Figure 2: Advanced Cruise Missile Layout



* General Dynamics Convair Division ACM Subsystem Familiarization Guide Figure 1.0-1 & 1.0-2

Figure 3: Advanced Cruise Missile Schematic

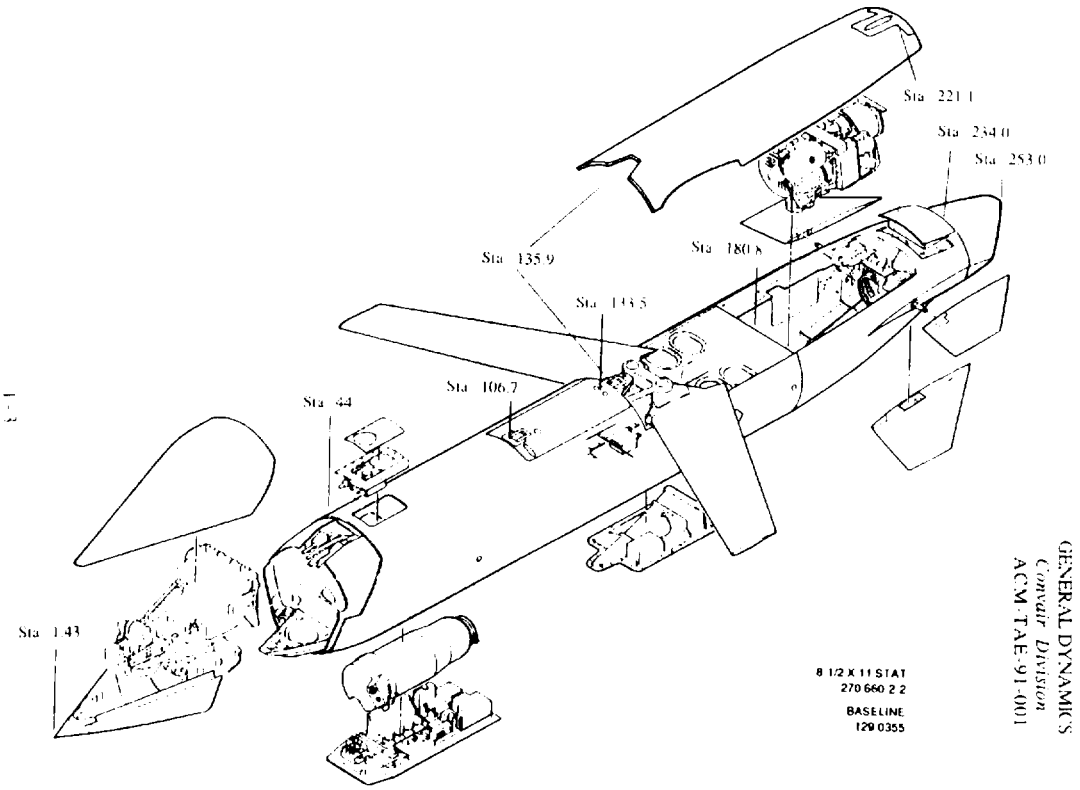
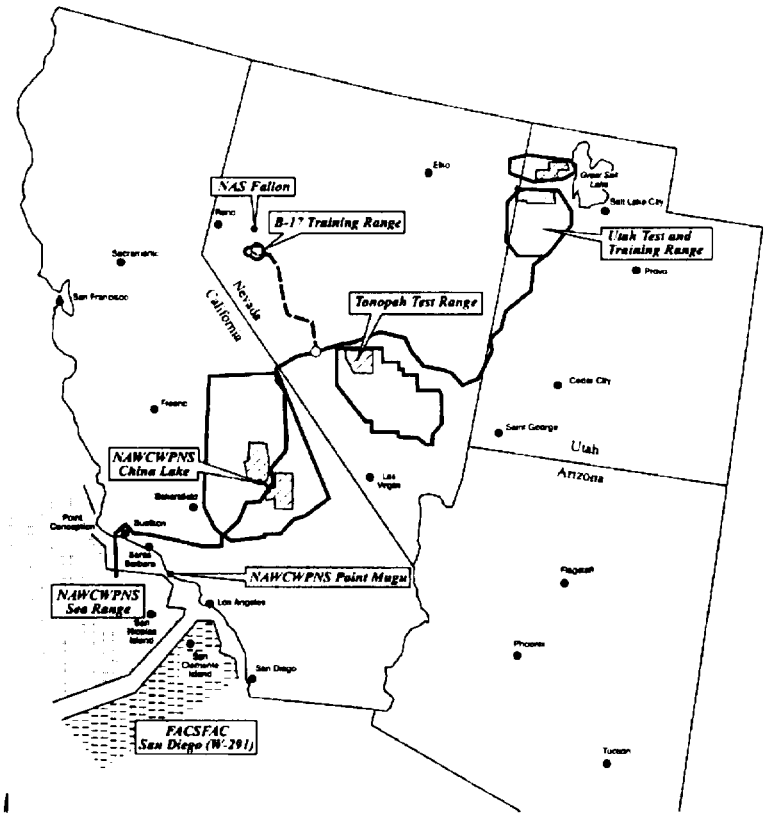


Figure 1.0-2 ACM Structure

I: THE UTAH TEST and TRAINING RANGE (UTTR)

UTTR is part of the Western Range Complex, shown in the diagram below.

Figure 4: Western Range Layout



The Utah Test and Training Range (UTTR) is an Air Combat Command (ACC) training range with infrastructure to support Large Footprint Weapons Testing. Air Launched Cruise Missile (ALCM), Tomahawk Land Attack Cruise Missiles (TLAM), and Advanced Cruise Missile (ACM) are Large Footprint Weapons, all of which have been and can be flown at UTTR.

UTTR is a designated Major Range Test Facility Base (MRTFB) under the Commander, 388 Fighter Wing (the 388 RANS), the designated operating agency for the range. UTTR activities are conducted in compliance with AFI (Air Force Instruction) 13-212, Volumes 1-3 and supplements. The UTTR is located in northwestern Utah and eastern Nevada. The Mission Control Center (MCC) is located off range at Hill AFB and is connected via microwave/fiber links. The large flat expanse of range has an average elevation of approximately 4,200 feet above sea level. On the North Range 348,767 acres are DoD owned, the South Range, including Dugway Proving Ground, there are 1,341,27 acres (14,595 acres extend into Nevada). Much of the UTTR airspace is over Bureau of Land Management (BLM) land. Ground operations on BLM land must be approved by BLM

Tomahawk Flight Test Operations on the West Coast of the United States. Fig. 1-1

prior to the program commencement. Figure 9 shows the geographic area encompassing UTTR.

RANGE CAPABILITIES

Key capabilities of the UTTR used to support cruise missile tests are optical tracking, radar tracking, radio and telemetry relay, and ground stations capable of transmitting either remote control or flight termination instructions to the missile. All UTTR test areas are capable of munitions tracking, data collection and transfer, telemetry acquisition and recording, communications, mission control, and full data reduction. Test functions are remotely monitored and operated from the test Mission Control Center at Hill AFB, Utah

BOUNDARIES

Airspace boundaries do not necessarily coincide with the boundaries of the DoD land beneath this airspace. The UTTR encompasses 8,125 sq NM of restricted airspace, (approximately the size of the state of Massachusetts), which can be expanded to 17,000 sq NM (Massachusetts and Vermont) through adjacent Military Operating Areas (MOAs) (in an area 207 by 92 NM). Land space is 2,700 sq NM of DoD land and 14,300 sq NM of Bureau of Land Management, State of Utah, and a small amount of privately owned lands underlying the restricted air space and MOAs. This includes the land owned by the Skull Valley Indian Reservation. This large airspace and ground space allow for large safety footprints and long trajectory legs required by Precision Guided Munitions (PGMs) and cruise missiles. Major munitions test areas include: 12 targets for testing conventional munitions; four highly instrumented targets used for testing of PGMs, smart armament/munitions, and home on emitter seeking missiles; four cruise missile impact targets; and five air to surface tactical target complexes.

CONTROLLED AIRSPACE REGIONS

The Airspace over the UTTR consists of 10 Restricted Areas and 8 Military Operating Areas (MOAs). Restricted Areas[1], Military Operating Areas and Special Use Airspace are military controlled airspaces to conduct operations and test and are defined on the Definitions page.

Within the UTTR, Restricted Areas and MOAs are as shown in Figure 9 with the following altitude limitations[2]:

---

[1] AFI 13 – 212 Volume 1 Weapons Ranges page 25

[2] AFI 13 – 212, UTTR Supplement (1) TEST, page 9, para 2.3

Restricted Areas

R6404A	Surface to Flight Lever FL) 580 (58,000 feet)
R6404B	Surface to 13,000 Mean Sea Level (MSL)
R6404C	100' Above Ground Level (AGL) to FL280
R6404D	from, but not including, 13,000' MSL to FL 250
R6405	100' AGL to FL 580
R6406A	Surface to FL 580
R6406B	100' AGL to FL 580
R6407	Surface to FL 580
R6402A	Surface to FL 580
R6402B	100' AGL to FL 580

Military Operating Areas (MOAs)

Lucin A	100' AGL to 9,000' MSL
Lucin B	100' AGL to 7,500' MSL
Lucin C	100' to 6,500' MSL
Sevier A	100' to 14,500' MSL
Sevier B	100' AGL to 9,500' MSL
Sevier C	14,500' MSL to, but not including FL 180
Sevier D	9,500' MSL to, but not including FL 180
Gandy	100' AGL to, but not including FL 180

The proposed storage area is located under Sevier B MOA in the South Range area of the UTTR as shown in Figure 5. It is important to note that Sevier B MOA is 118 nautical miles long from the North to the South, and is 38 nautical miles wide at its widest point from the east to the west. However, we are only concerned with the northernmost portion of the MOA, in Skull Valley. Northern Sevier B MOA dimensions are a maximum of 13nm to a minimum of 6nm wide from east to west.

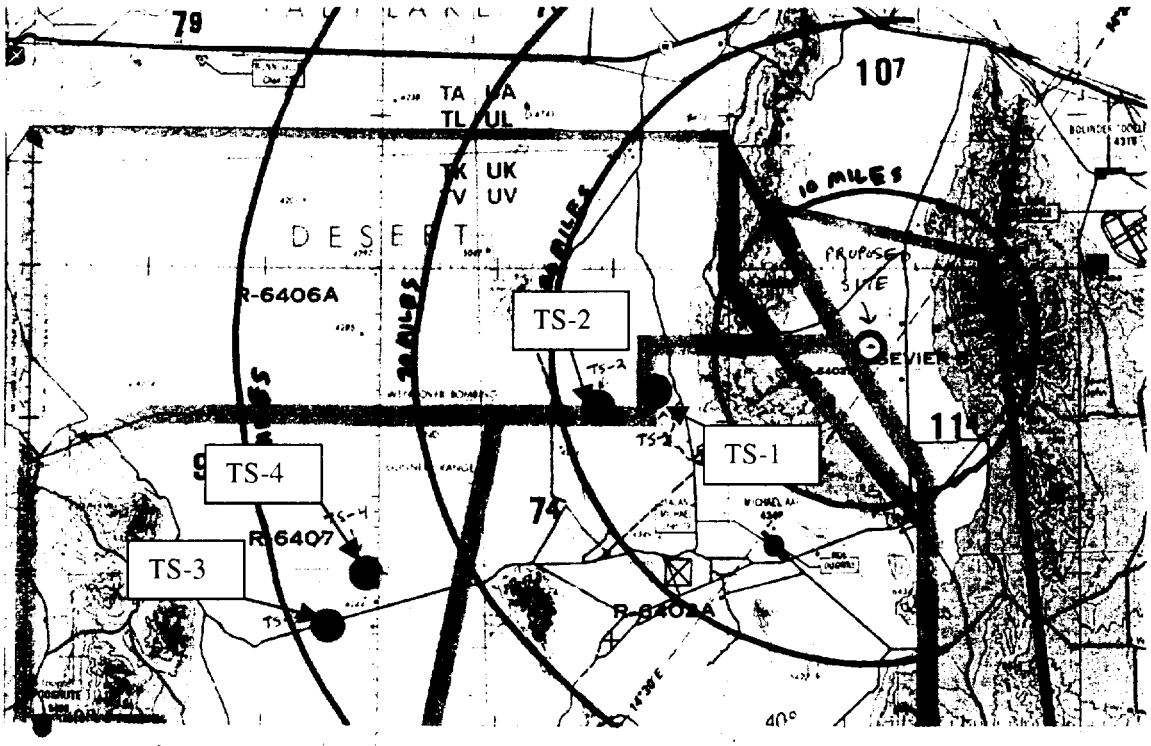
TARGET AREAS LOCATED ON THE UTTR RANGE

All cruise missile designated targets, TS-1 through TS-4, are located on the South Range, as follows:

	Latitude	Longitude
TS-1	40° 22' 22"	N113° 06' 37" W
TS-2	40° 21' 06"	N113° 11' 38" W
TS-3	40° 06' 50"	N113° 34' 15" W
TS-4	40° 08' 07"	N113° 31' 10" W

These are shown plotted on Figure 5.

Figure 5: Cruise Missile Primary Targets



TACTICAL PILOTAGE CHART

TS-1 is the primary cruise missile target, and is located 15 nautical miles (17.0 statute miles) west of the proposed storage facility. TS-2 is 18.2 nautical miles (20.7 sm) west, TS-3, 37 nautical miles (42.0 sm) west and TS-4, 39.1 nautical miles (44.4 sm) west, are also authorized for use as targets for Flight Termination System (FTS) equipped cruise missiles. The TS-1 target is located in restricted area R-6402A. TS- 2 target is located in R6406A. TS-3 and TS-4 targets are located in R- 6407. Run in headings for all cruise missile tests are established by individual test requirements and safety reviews[1].

AIR ACCESS

Air traffic control is maintained in the UTTR range by Clover Control[2] (299th Range Control Squadron [RCS]), Through a Letter of Agreement with the Salt Lake Air Route Traffic Control Center (ARTCC), Clover Control has been delegated control of the airspace that comprises the UTTR. Clover Control has proprietary control over what aircraft enter, exit, and the duration during which aircraft utilize their airspace and rangeland. Range airspace access is strictly controlled according to the range schedule. Figure 6 below depicts the UTTR Air Traffic Control Sectors, Figures 7 and 8 show,

[1] AFI 13-212 UTTR Supplement (1) TEST, page 20
[2] AFI 13 –212, UTTR Supplement (1) TEST, page 9

respectively, the high (above 18,000 feet) and the low (below 18,000 feet) civil routes. Figure 9 shows the military low-level route structure associated with UTTR.

Figure 6: UTTR Air Traffic Control Sectors

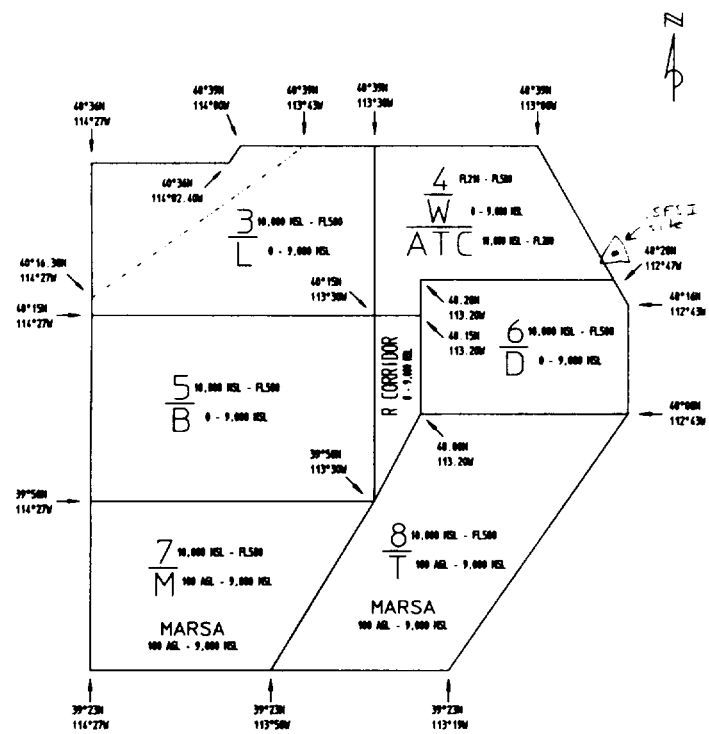


Figure 3. South Range High and Low Sectors.

Figure 7: High Enroute Chart Showing Restricted Airspace

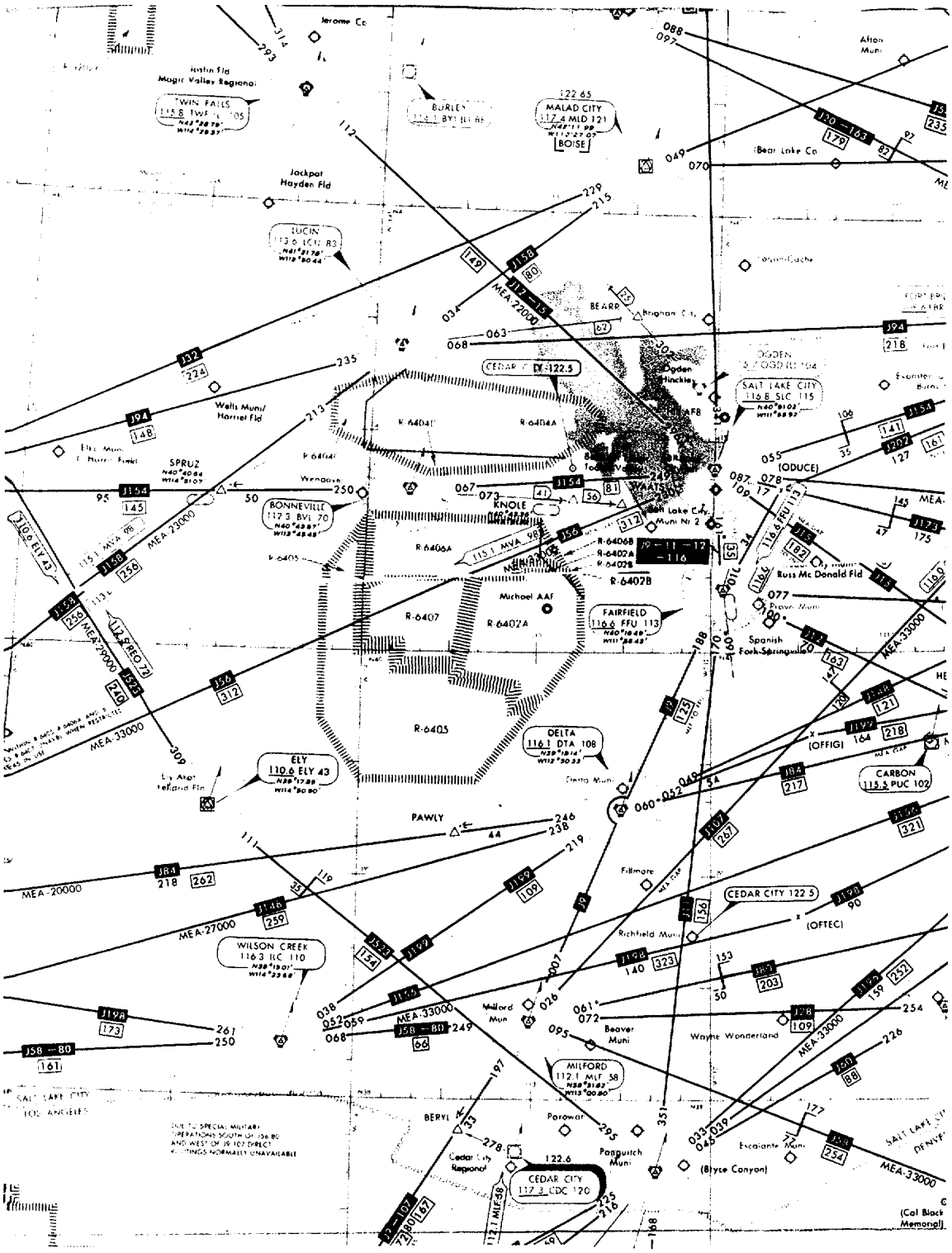


Figure 8: Low Enroute Chart Showing UTTR Close Up View

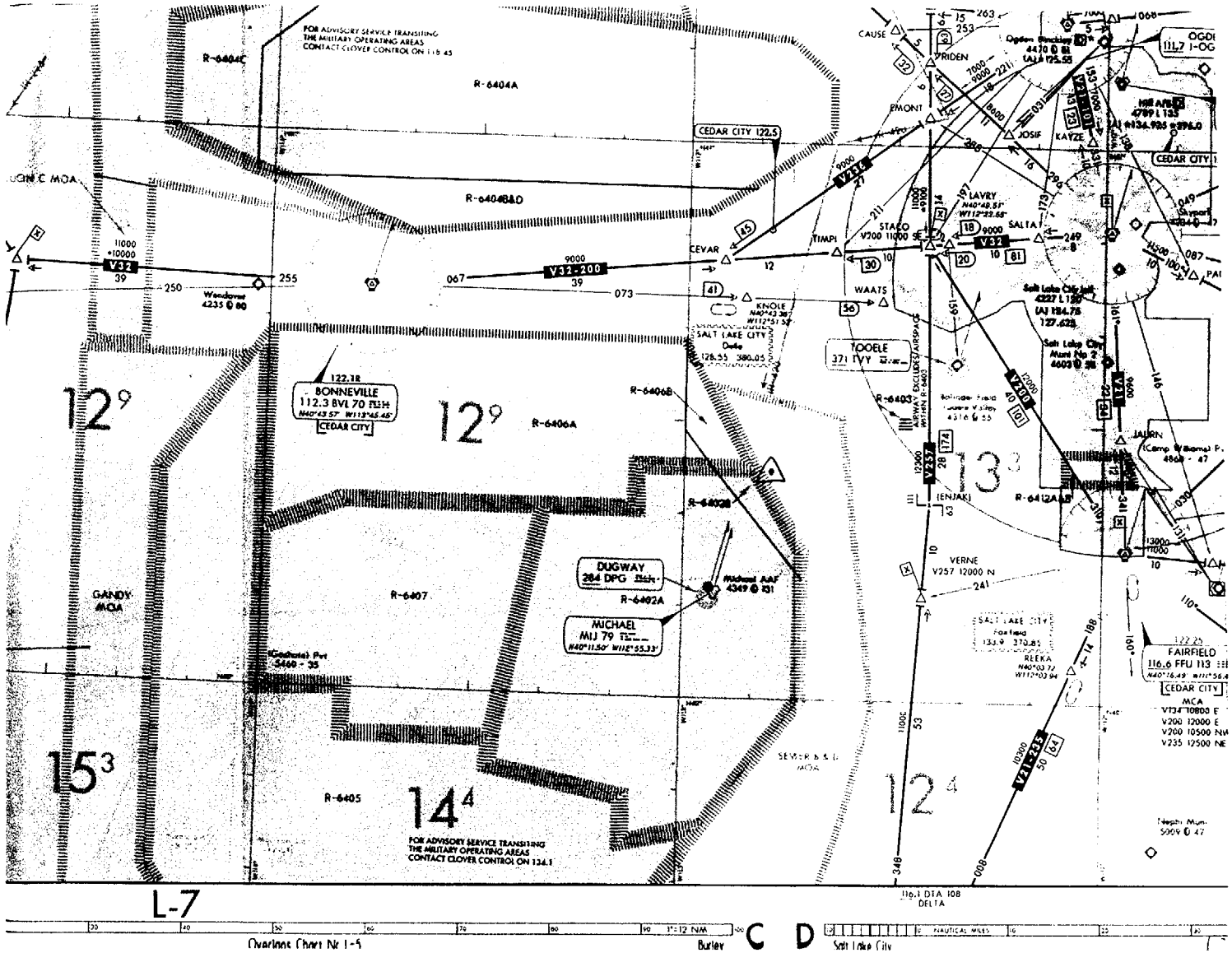
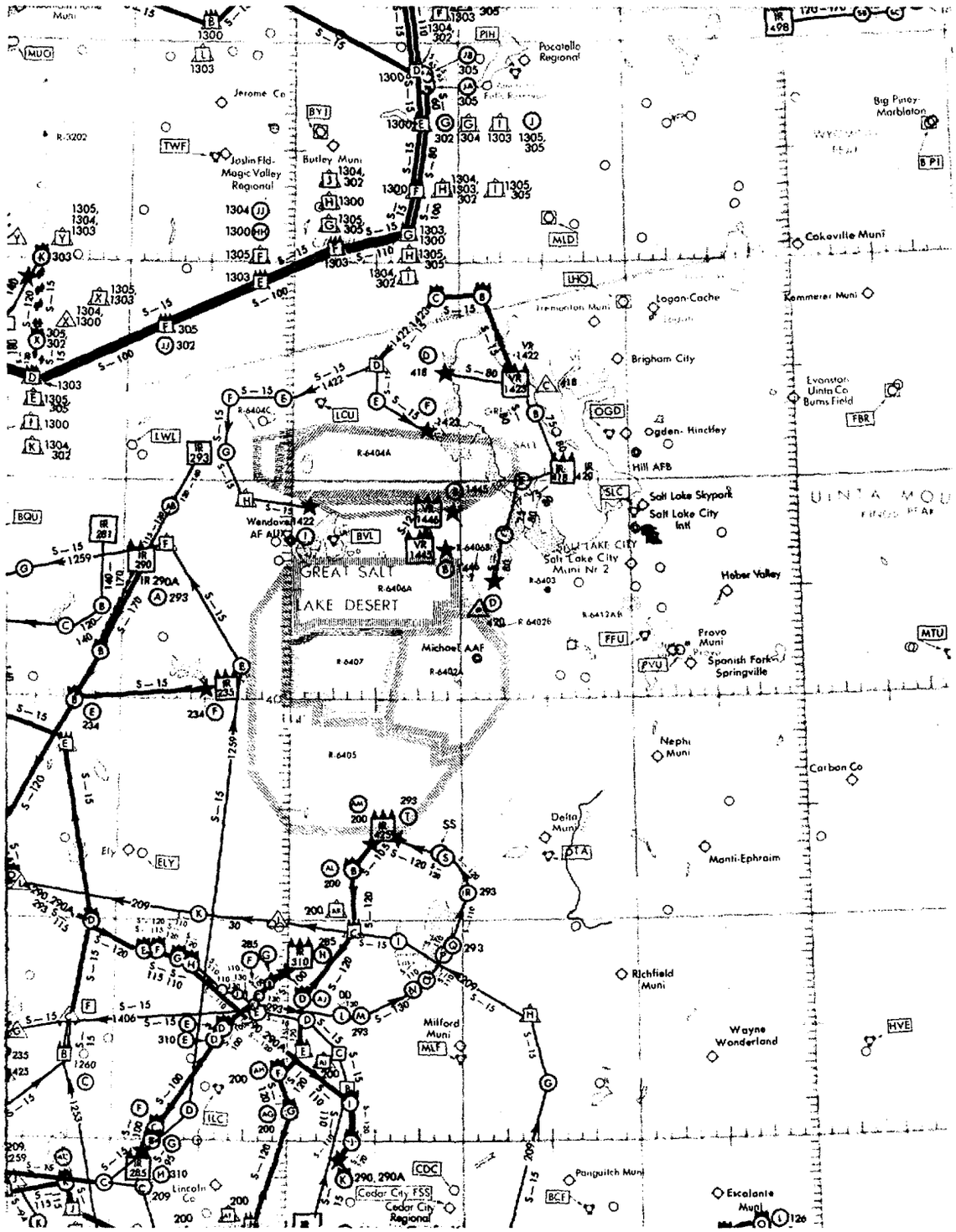


Figure 9: FLIP Military Route Planning Chart



See Figures 10, 11 & 12 for a scaled in view of the UTTR landmass, Restricted Airspace and Military Operating Area (MOA) regions. These Figures depict these areas from an

overhead perspective from the macro scale to the micro view of the proposed storage facility. The storage site is depicted on each scaled chart by a star symbol.

Figure 10: Macro Overhead View of UTTR Airspace

Figure 11: Intermediate Overhead View of UTTR Airspace

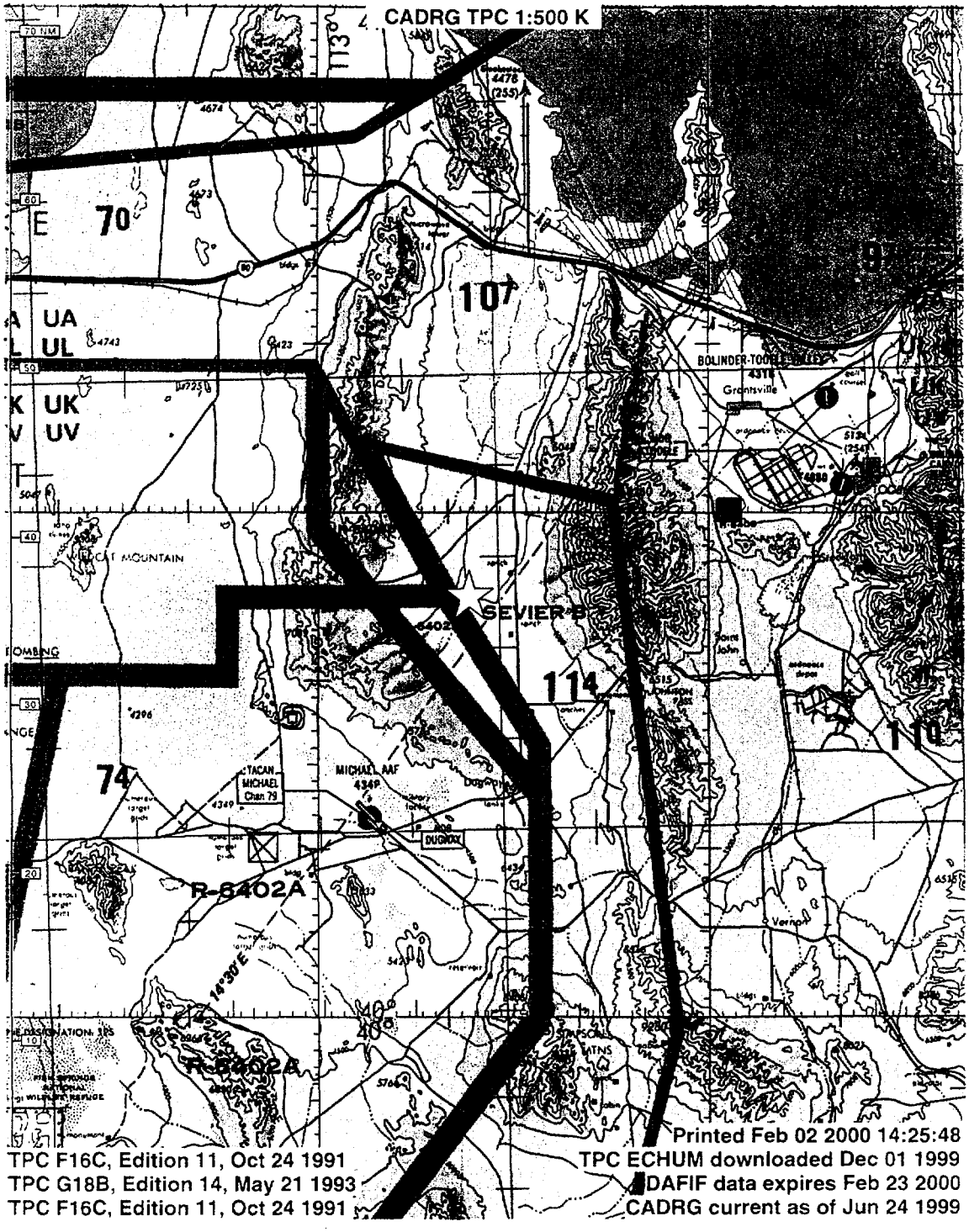


Figure 12: Micro View Showing Indian Reservation

GROUND ACCESS

Land access is also strictly controlled[*]. All personnel who require access to Department of Defense (DoD) land areas of the UTTR must receive proper authorization before

[*] AFI 13 –212, UTTR Supplement 1 (TEST) page 5 paragraph 1.5 Ground Party Requirements

entering. Entry into U.S. Army (USA) property must be coordinated through the USA at Dugway Proving Ground.

II: CRUISE MISSILE TEST PLANNING

PLANNING PROCESS

Cruise Missile tests are strictly controlled events, with a comprehensive planning process in place that governs preparation for each test operation. Program offices, operating commands, and test organizations have been directed to employ a disciplined test process throughout all phases of an armament/munitions life cycle. This process applies to all testing including developmental, operational, and combined testing. Air Force Manual 99-104 Armament/Munitions is a 48-page source manual, which details weapons and the cruise missile test process. This testing is an iterative process intended to reduce risk[1].

Many regulations govern the conduct of cruise missile testing. These include Air Force regulations, Air Combat Command regulations, Utah Test and Training Range regulations and Aircraft technical orders. See References A, B, E, F, G and S.

The 49 TESTS Squadron located at Barksdale Air Force Base, Louisiana is the responsible test organization for Air Combat Command's cruise missile testing program. United States Strategic Command at Offutt Air Force Base in Omaha, Nebraska and Air Combat Command at Langley Air Force Base, Virginia has oversight of the cruise missile testing process.

Planning typically starts many months in advance of the test, to allow proper preparation and safety review of the test plan[2]. The methodical process includes tasks, with specific responsibilities assigned, for a safe and successful test. The steps in the process include:

- Integration of Objective and Compliance Criteria:
  - Integrate the proposed test objectives to ensure a complete and cohesive set of test requirements.
  - Construct a Test Plan that satisfies all of the objectives, while ensuring that the mission is safe, efficient and economical. **Safety is the over-riding concern.**
- Mission Planning:
  - Specify the Software and Testing Objectives
  - Specify the Missile Flight Route and Restrictions
  - Plan the Mission
  - Analyze and Validate the Planned Mission to ensure compliance
  - Distribute the Mission Plan for use
- Target Preparation

---

[1] Air Force Manual 99-104, page 10, para 2.3.1.2

[2] Tomahawk Test and Evaluation Directive Number 18A, Tomahawk Flight Test Planning.

    - Select target and validate its precise location
    - Develop mission scoring rules
    - Designate support system requirements for monitoring and scoring
- Missile Preparations
    - Designate configuration of missile for flight test
    - Validate the configuration
- Launch Platform Preparations
    - Designate the launch platform configuration for the test
    - Develop specific Test Operations Procedure
    - Train and Certify the launch platform and crew
- Test Operations and Contingency Planning:
    - Detailed Plan of operations for the test
    - Development of actions, procedures, contingency and emergency plans
- Data collection planning
- Mission Firing Plan:
    - Launch Platform procedures
    - Countdown timelines
    - Go/No Go decision criteria
    - Mission recovery or termination requirements
    - Contingency plan for anomalous events
    - Contingency plans and responses
- Data Distribution Plan
- Mission Scoring Plan
- System Readiness Assessment
    - Ensure all test elements are fully integrated and capable of carrying out the test, including firing unit, range and support assets.

Preparations for each and every cruise missile flight test are intensive and lengthy. With test missile and funding limitations, the plans are scrutinized throughout their development, with safety always the primary overriding principle, to ensure a successful test. Key items of concern throughout the planning for each test are:

- Achievability -- Are sufficient measurements, methods, test resources, and instrumentation available?
- Executability -- Can the objectives be accomplished within program constraints and limitations?
- Safety -- Can the test be performed safely?
- Utility -- Do the test objectives clearly and conclusively evaluate the desired feature?
- Cost -- Can the customers afford the cost of the objective?
- Schedule -- Is sufficient time available to accomplish the objective?
- Environmental Impacts -- Can the objectives be accomplished without adverse effects on the environment?

Two of these topics concern the focus of this risk assessment: Safety and Environmental Impacts. Test safety and environmental concerns are cornerstone-planning considerations

throughout the test planning and execution phases of every test. They are present at the genesis of any and all test concept and planning efforts and remain forefront through the end of the test.

III. CRUISE MISSILE TEST SAFETY REVIEW

Safety and risk reduction initiatives are built into every aspect and phase of cruise missile test operations[1]. Viability of existing weapons inventory is an essential function of the test and evaluation community. Another incumbent responsibility of this community is the minimization of the inherent risks to both civilian and military lives and property associated with such weapons testing[2]. The Air Force has a responsibility to protect the public to the maximum extent practicable from the hazards and effects associated with flight operations conducted on their ranges. To this end, a through safety review process is in place for weapons testing.

REVIEW PROCESS

The 388th Range Squadron develops cruise missile[3] testing procedures that require operational hazard analysis and formal safety reviews of all test programs as well as safety reviews of particular test missions[1]. The safety review has established the following primary measures to minimize risks:

- Missile preparation
- Aircraft software preparation
- Carrier aircraft preflight inspection
- Missile loading by trained personnel, under supervision, with checklists
- Software and missile fault tests
- Missile ejection circuitry analysis
- Real time monitoring of launch circuitry by test personnel
- Routes planned to avoid property and personnel
- Remote Command and Control (RCC) capability to steer missile
- Flight Termination System (FTS)
- Weather minimums ensure chase aircraft can follow missile
- Advanced Range Instrumentation Aircraft (ARIA) relay of telemetry data to Mission Control Center (MCC)
- MCC real-time picture for timely safety decisions
- Remote control system and flight termination system parameters and plans keep missiles in safe areas
- Flight termination system components are independent of missile normal control mode
- Airborne Range Instrumentation Aircraft (ARIA):
- Crew member training on RCC/FTS
- ARIA relay of Telemetry Relay (lets test conductor know if missile is receiving FTS carrier signal)

---

[1] Air Force Manual 99–104 Armament/Munitions Test Process, page 7; Figure 2.2 The Air Force Test and Evaluation Process

[2] AFI 13 – 201 Air Force Airspace Management page 26 & 27. Protection of Civilian Population and Communities

[3] AFI 13-212, UTTR Supplement 1 (TEST) page 14

- Radio relay from Mission Control Center (MCC) to chase aircraft
- FTS signal monitoring (so ARIA crew can warn chase or MCC of hazards)
- ARIA transmits of FTS carrier signal
- Weather criteria
    - Ensure chase aircraft can see missile and ground
    - Ensure chase aircraft can refuel from tankers
    - Criteria for test execution prevent exceeding these limits
- Four chase aircraft required (3 minimum for go)
- Tanker for refueling - required for go
- ARIA aircraft - required for go
- Operational MCC - required to go
- Ground recovery team - required for go
- Helicopter for recovery team required for go
- Contingency procedures to take if elements drop out
- Multiple tracking capabilities to monitor missile flight path at all times

The organization responsible for conducting operational tests of cruise missiles (49th Test Squadron at Barksdale AFB, LA) publishes detailed test instructions specifying additional safety criteria, test team membership and duties, and detailed checklists. In addition, they maintain a comprehensive lessons learned program from earlier tests[1].

APPROVAL PROCESS

Prior to each test, the Range Control Officer convenes a Safety Review Board (SRB) between 60 and 45 days before the start of testing. The SRB reviews the Operating Hazard Analysis and the approved test plans provided in advance to Range Safety[2]. The customer must be present at the SRB, and is bound to comply with all range restrictions and the procedures approved by the SRB.

The Range Test Director is responsible for and is the final decision making authority during all phases of test conduct and preparation. He also monitors mission development to ensure achievement of all flight objectives and ensures each test team member is assigned specific responsibilities. He along with the Range Control Officer convenes the Safety Review Board. Key personnel are listed in the ACM Operations and Procedures Manual[3]. Additionally he uses teleconferences to conduct the briefing schedule as listed in References A, B, and C in the aforementioned manual.

---

[1] AFI 13 – 212 Vol. I Weapons Ranges, Chapter 2, page 14, Ensuring Range Safety
[2] AFI 13-212, UTTR Supplement 1 (TEST) page 14, para 3.3
[3] ACM Operations Concepts and Procedures page 1 to 2.

IV. CRUISE MISSILE TEST EXECUTION

In preparation for each test, routine meetings are held shortly before the execution of the test to ensure that the test can be properly and safely conducted.. The program organization responsible for the system reviews and approves the specifics of the mission in a Mission Readiness Review, and the Range approves the accomplishment of the mission on its range as described in Section III.

A typical set of normal cruise missile test procedures are listed in the Advanced Cruise Missile (ACM) Operations and Concepts and Procedures manual, Reference S. These procedures optimize the launch aircraft and missile configuration, meteorological and atmospheric conditions and generally maximizes safety before the missile is launched. As part of the pre-launch process, briefings are conducted, mission readiness is assessed, communication, control and telemetry links are checked, range weather is confirmed, safety concepts are reconfirmed, remote command and flight termination system is checked and verified, air refueling procedures are discussed, air and ground range readiness is confirmed and photo chase requirements are double checked.

Contingency operations are also heavily reviewed prior to any scheduled cruise missile launch. Mission Control evacuation plans are reviewed. Hung weapon and weapon jettison procedures are discussed. Loss of Advanced Range Instrumentation Aircraft (ARIA) UHF radio relay, loss of Remote Command and Control (RCC) are reviewed. Loss of visual contact with missile, loss of chase aircraft, loss of ARIA, loss of tankers, and chase aircraft radio loss are studied. Stern application of tested and proven checklists exists for these and other contingencies. Strict protocols derived from lessons learned are applied anytime deviations are noted before, during, and after missile free flights. Rigorous checklist disciplines during unusual situations maximize range safety at all times.

In planning each mission, buffer lines (also known as termination lines) define the areas on ranges or along planned route structure that the missile will not be allowed to penetrate. At the Utah Range a line 2 nautical miles inside any Warning Area, Restricted Area, or Military Operating Area (MOA) boundary are enforced. In our situation, no missile flights are conducted in Northern Sevier B MOA or in Restricted Areas R-6406B or R-6402B as stated by Mr. Don Good from 49th TESTS Squadron at Barksdale AFB, LA Skull Valley and the ISFSI are avoided by at least 10 nautical miles. See Reference U.

For cruise missile tests, given their autonomous nature, significant attention is given to closely tracking the missile throughout its flight. Each missile must have an approved Flight Termination System (FTS) installed so that it can be commanded to alter route or to terminate its flight by a human. While flying, the missile is literally tracked by eyeball by a pilot in a chase airplane to ensure that the missile is performing properly in flying characteristics as well as route compliance.

Advanced Cruise Missile (ACM) Operations Concepts and Procedures pages 24-28

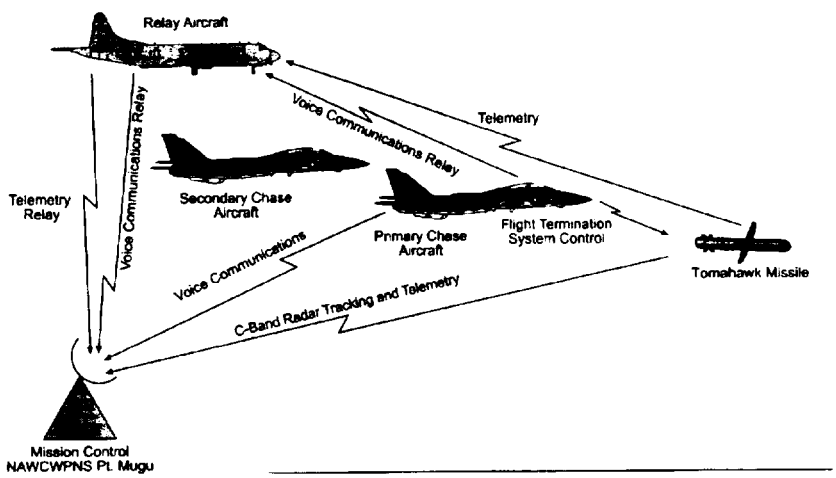
Typical airborne assets employed to conduct a cruise missile test for ALCM or ACM include:

- One B-52 mothership with the cruise missile loaded on either an external pylon in the case of the Advanced Cruise Missile or internally on a rotary launcher in for the Air Launched Cruise Missile.
- One E-135 Advanced Range Instrumentation Aircraft (ARIA) to control the missile if necessary and gather the telemetry stream containing vital missile parameters
- Four to eight F-16/F-14 chase aircraft with Remote Command and Control (RCC) pods to manually fly the missile in the event this becomes necessary.
- Two T-38 photo chase aircraft as mission needs dictate.
- Two KC-10 tankers or four KC-135 tankers to refuel the chase aircraft.
- And finally two to three helicopters to recover the missile and control the missile landing area.

All of these aircraft are operated under the control of the test conductor located at the range control facility on the ground, or airborne from the ARIA aircraft[1].

A typical mission, using Tomahawk as an example, is depicted in the following schematic[2]:

Figure 13: Typical Navy Enroute Formation During Mission



[1] Advanced Cruise Missile Operations Concepts and Procedures, page 14a
[2] Tomahawk Flight Test Operations on the West Coast of the United States, Fig. 2-7

In addition to the aircraft tracking the missile throughout its mission, the ground control station monitors the missile's performance and key operation parameters through the integrated telemetry system in the missile to detect malfunction or unexpected events. The ARIA aircraft has the ability to take control of the missile in flight and "manually fly" the missile should override of the pre-planned mission be necessary due to an unexpected airspace occurrence, in coordination with range control. Both range control and ARIA aircraft have the ability to terminate a missile's flight should it be detected operating abnormally in relation to flight or mission plan. The FTS provides both these abilities, and is described more fully in Section V.

Operations on Range for cruise missiles are conducted according to the pre-planned mission. When on-range, the missile's route is pre-planned to meet range restrictions. In planning each mission, buffer lines (also known as termination lines) define the areas on ranges or along planned route structure that the missile will not be allowed to penetrate. At the Utah Range a line 2 nautical miles inside any Warning Area, Restricted Area, or Military Operating Area (MOA) boundary are enforced. In our situation, it is legal to fly a missile in Sevier B MOA West of a line 2 nautical miles inside the eastern Sevier B MOA boundary, however this is no longer done due to the increasing manned presence in the area of the proposed storage facility . There are 17 "no fly" areas in the Skull Valley. Cruise missile flights are prohibited over these areas. As such the test conductors at the 49th TESTS Squadron have elected to avoid the entire Skull Valley for cruise missile testing.

A standard, commonly flown cruise missile route is depicted in figures 14 and 15. It is split in to a north range half and a south range half due to sizing restrictions. The closest point of cruise missile approach to the PFSF site on this route is approximately 10 nautical miles (11.3 statute miles). The majority of the route as we can see is well to the west and south and north of the site.

Interview with Mr. Boe Hadley, the UTTR Range Control Officer

Figure 14: North Range Cruise Missile Routing

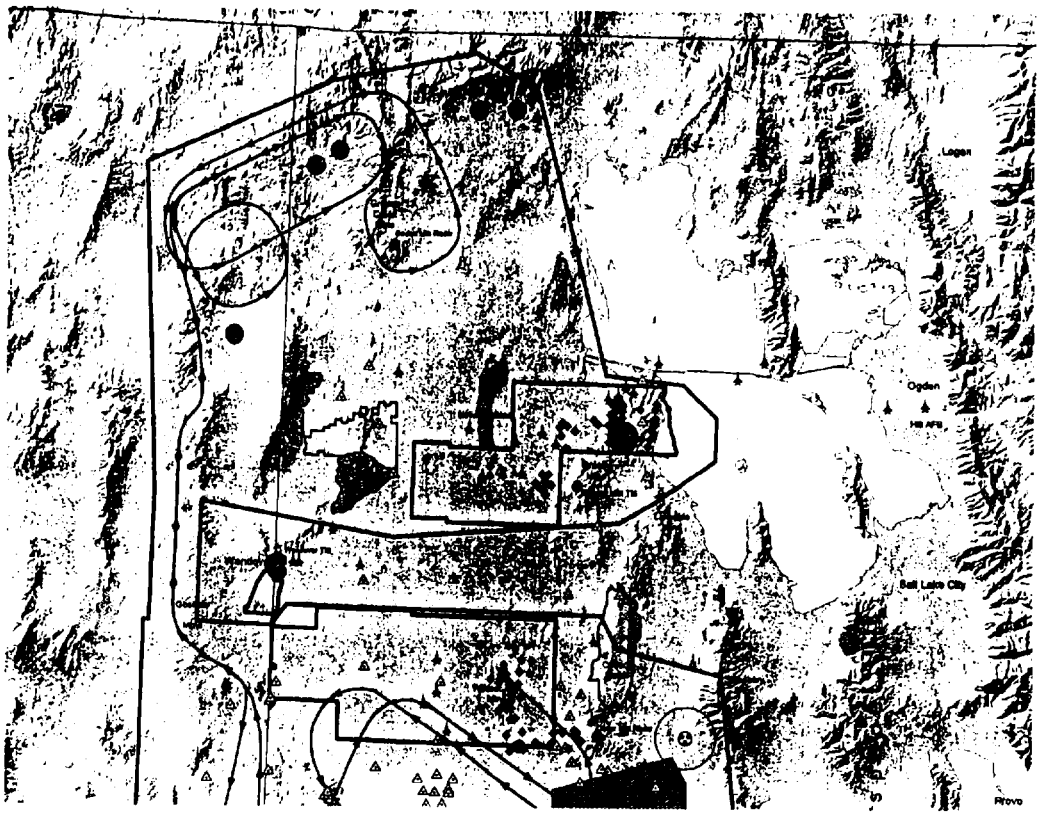
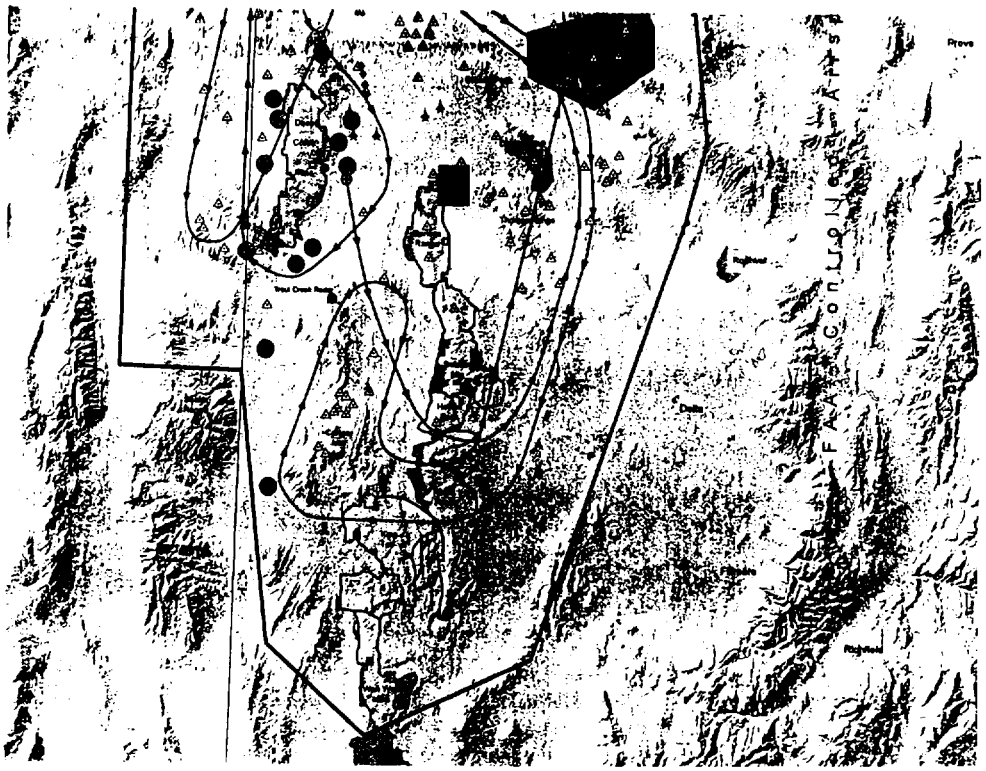


Figure 15: South Range Cruise Missile Routing



The closest point of the route to the PFSF occurs as the missile starts it run-in to the target areas.
Target areas are well defined in UTTR, with TS-1, TS-2, TS-3, and TS-4 the targets used for cruise missile testing (see Figure 5).

SUMMARY

Test operations are carefully planned and controlled throughout their duration. With painstaking procedures utilized to plan the mission and with continuous monitoring throughout the flight, each missile is under scrutiny of many "eyes" to ensure that it is performing according to plan. If any deviation is detected from the planned mission, control of the missile is "taken" by the chase or monitoring crews, and the missile flown to the contingency recovery point.

V: FLIGHT TERMINATION SYSTEMS (FTS) AND PROCEDURES

FTS REQUIREMENTS

Large footprint weapons (cruise missiles) with the capability to exceed UTTR land boundaries or endanger range assets, manned sites and sensitive areas must have an FTS designed, tested, documented and certified In accordance with Range Commander's Council (RCC) Standard 319-92 or latest revision. Compliance with this standard ensures that the FTS is compatible with the range systems and procedures.

The Range Commanders Council Document 319-99 also dictates FTS performance requirements. This 750-page document details every aspect pertaining to Flight Termination Systems. Chapter Four details requirements for remotely piloted vehicles and cruise missiles, with 75-pages devoted to these vehicles. The standards are rigorous and redundant. There is no more thoroughly scrutinized subsystem on the cruise missile.[1]

A typical FTS designed and developed for the Tomahawk cruise missile is described in Reference J.

FTS APPROVAL / CERTIFICATION

The FTS must be approved for use on the range where it will be employed. Configuration approval is granted only after acceptance of the FTS report and successful demonstration of the complete system. The Range Squadron Safety Office participates in the design and development of any FTS which may eventually be used on the UTTR, to ensure compliance with RCC Standard 319-92, or the acceptance of any deviation from this standard. Systems approved for use on one program are not automatically authorized on another program. Any changes or modification to approved system, components or test procedures are reviewed by Range Safety Squadron, and a re-certification process may be necessary if substantive changes are contemplated.

During FTS system design, provisions are incorporated for the display of the following real-time telemetry and Time, Space, Position, Indicators (TSPI) parameters so the Range Safety Officer (RSO) can monitor the missile during flight:

- TSPI from a source independent of vehicle telemetry (two sources highly recommended).
- Test vehicle altitude, attitude and heading
- Radio Frequency signal strength at both FTS receivers
- Energy level (voltage) of primary and backup power supplies used to power the FTS receivers, sequencers, and termination mechanism
- Status of all safe-and-arm devices, lanyards, wing switches, etc.

---

[1] Range Commanders Council Document 319-99 Flight Termination Systems Commonality Standard Ch 4

- Status of all FTS tone logic signals, e.g. MONITOR, ARM, TERMINATE
- Temperature of temperature critical components such as batteries and receivers
- Fail-safe timer status
- Any other FTS parameters deemed necessary by the Range Safety Officer.

FTS PROCEDURES AND OPERATIONS

There are two key modes of terminating a cruise missile's flight using the FTS:

(1) By command from the range when the missile is detected operating improperly, such as deviating from plan, or if a range safety conditions requires terminating the flight. Safety officers can activate the FTS at any time. The Range Safety Officer at Mission Control and the Airborne Range Instrumentation Aircraft are both capable of terminating the cruise missile flight almost instantly.

(2) Loss of the constant carrier signal required to be received from the range or one of the supporting aircraft. At all times throughout the flight the cruise missile FTS must detect a signal that in effect permits the continued flight of the missile. If the missile does not detect the signal for a preset time, the FTS activates, causing the missile to tumble and crash. This arrangement is functionally equivalent to a dead-man switch. This accommodates a missile-losing signal (more importantly loss of telemetry feedback for monitoring the missile's health and status) should the missile reach a "shadow" zone in the flight. By manually terminating the carrier signal, the flight can be terminated in this manner as a secondary means.

In addition to providing flight termination means, the FTS also provides override capabilities to the range and support aircraft to redirect the missile's flight path should that be required. Override control is employed, for example, to remain clear of clouds, to redirect a missile if an anomaly is detected in flight (visually or through telemetry), or in the event the missile needs to be steered clear of unanticipated encroaching aircraft.

Before execution of the mission and early in flight, the FTS override system is tested in flight. Before a launch platform (bomber) launches a test cruise missile, the Mission Control Center (MCC) verifies that the missile's Remote Command and Control (RCC) and Flight Termination System (FTS) are working properly. Once launched, the missile override controls are quickly checked to ensure that positive control of the missile is available and working properly. Throughout its flight, the missile transmits measurements that confirm it is receiving the authorizing signal (and the strength of that signal) to Mission Control via the telemetry stream, as well as critical operating parameters for the ground crew to monitor missile health and status.

RCC signals originate from the command and control panel of the aircraft monitoring the test missile in flight. These signals are received and decoded by the missile's range safety equipment and are transmitted to the missile guidance set which computes control

signals for the engine and fins. Range safety commands are divided into three groups: manual control, on track control and emergency control. Manual control gives range safety personnel all axis control of the air vehicle. With on-track control the air vehicle can be commanded to climb, hold altitude, or descend on the planned track. Emergency control allows either commanded or loss of power termination. There are two methods of terminating air vehicle flight as described above. When flight terminate signals are received by the unit, the decoder and guidance set are bypassed and terminate signals go directly to the engine and fins. The terminal maneuver consists of the horizontal fins being commanded to null, the vertical fin is commanded to full leading edge right and the throttle is commanded to off.

COMMAND AND CONTROL DURING TESTING

The missile relays all instructions its remote control system receives at the same time it carries out those instructions. Mission Control at Hill AFB and the Airborne Range Instrumentation Aircraft (ARIA) monitor these signals throughout the missile's flight. The missile remote control system permits steering the cruise missile to avoid weather and hazards, and allows manual intervention in case of missile malfunctions. Mission Control at Hill AFB and the ARIA can take manual control of the missile. Range transmitters can relay any commands from Mission Control. These transmitters are on high terrain but they do not provide continuous line of sight communication to missiles flying at low altitudes. The preferred control platform is the ARIA aircraft, because its signals are less likely to be blocked by terrain. Soon after the missile is launched on every test, ARIA takes manual control of the missile to check its response. Because ARIA cannot see the missile it works with chase aircraft to check the missile's performance.

Fighters "chase" (fly in company and visually in contact with the missile) the missile throughout its entire flight to ensure safety. They remain behind the missile, monitoring its performance and heading. If the missile is tracking toward a cloud, or if another aircraft enters the range, or any other problem exists, the chase pilot tells the ARIA controllers how and where to steer the missile to keep its safe. Two fighters are always "on the missile" while the other two fighters are refueling from the tanker. Chase aircraft follow the missile until it completes its mission.

VI: CRUISE MISSILE SYSTEM TESTING AT UTTR

HISTORY

There have been 13 documented cruise missile crashes at the UTTR in the last 10 years, as shown in Table 1. Nine were Air Launched Cruise Missiles (ALCM or CALCM, AGM 186B and AGM186C), and four were Advanced Cruise Missiles (ACM, AGM 129). Thirteen ALCM/ACM cruise missile crashes occurred in approximately 80 flights during this timeframe, a failure rate of 16%. As of 1998, 197 Tomahawk tests had been conducted. In that population, four (4) missiles failed during the cruise phase and crashed on non-military land along the planned flight path. There have be no failures during the cruise phase in the last 52 of those 197 flights. Based on these data, there should be less than two- percent chance of cruise phase failure for Tomahawk cruise missiles, if Tomahawk testing was resumed at the UTTR.

The UTTR crash sites are listed on the attached chart from Hill AFB, UT. None of the vehicles crashed within 10 nautical miles (nm) of the proposed ISFSI site. The closest crash site is 13 miles to the southwest. Another crashed 18 miles from the PFSF site and the remainder impacted more than 30 miles from the site, with the most distant 115 miles to the southwest. Assuming a nominal missile groundspeed of 420 knots, (all of the aforementioned vehicles are subsonic), the nearest cruise missile was almost 2 minutes flying time from the site. This is a long time considering that the FTS can be activated nearly instantaneously. All of the crashes over the past ten years have occurred on or within half a mile of the planned route (10 seconds of flight time). There has never been a cruise missile FTS failure at the UTTR. See Reference U.

Current plans call for approximately six cruise missile tests annually. These tests are Follow On Test and Evaluation launches conducted by the Air Combat Command's 49th Test Squadron. Basically these tests confirm the continuing viability of stockpile missiles that already exist in the USAF inventory. The flight characteristics of these missiles are well documented. Both the Advanced Cruise Missile (ACM) and the Air Launched Cruise Missile (ALCM) have been in the active inventory since the early 1990's. Tomahawk sea launched cruise missiles have been tested at UTTR in the past, with the last test there occurring in January 1988, but no flights are now scheduled for UTTR.

RANGE SAFETY

Cruise missiles and other unmanned systems are required to have profiles developed/ provided which avoid manned/inhabited locations. For vehicles with a range approved flight termination system on UTTR, manned locations shall be avoided by a horizontal distance equal to the AGL altitude or 3 NM above 18,000 ft AGL, 1 NM below 6,000 ft AGL. According to Mr. Boe Hadley of the UTTR Range Control Squadron at Hill AFB, UT, cruise missile routing includes a 3-mile standard buffer distance from any UTTR airspace boundary (see Reference T).

Response to Freedom of Information Request from Hill AFB, UT Public Affairs page 1
AFI 13-212 UTTR Supplement 1 (TEST) page 10 para 2.9.2

The US Air Force has published Trajectories from Flight Termination profiles[24] In a worst case scenario, the missile travels no further than 2nm after the terminate signal is given, and a maximum of 1.6nm along track at 6,000 ft AGL, as shown in Figure 16A and 16B below. The maximum distance the missile will travel laterally (i.e., perpendicular to the flight path) is 0.4 nm. The distances in Figure 16 A&B conservatively assume a 50-knot wind blowing in the most disadvantageous direction.

[24] Tomahawk Sea Launched Cruise Missile System Flight Termination System Report. pages 2-13 through 2-16

Figure 16A: Downrange Distance Graph After FTS Termination
(From Boeing Tech Order Data)

THE BOEING COMPANY

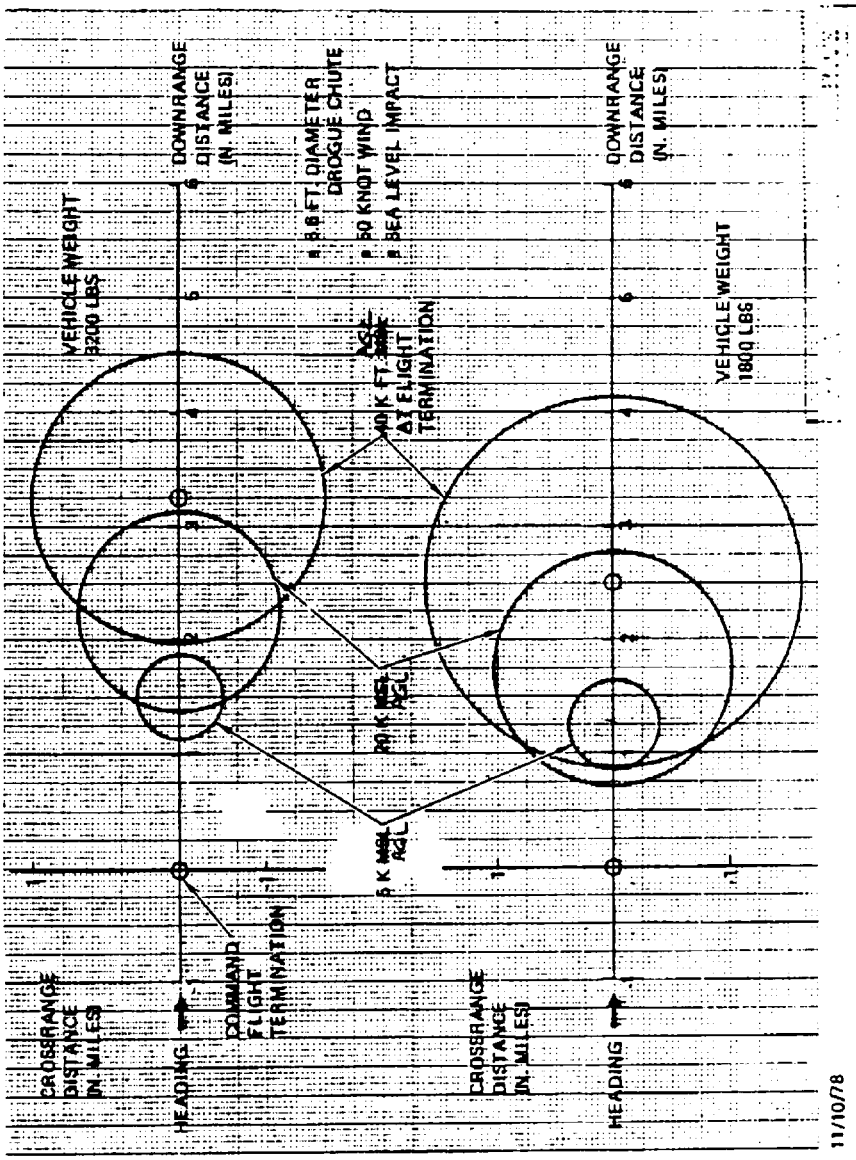


Figure 3.1-4. Air Vehicle Missile Impact Footprints

UNCLASSIFIED

Figure 16B: ALCM Cruise Missile Trajectory After Flight Termination

UNCLASSIFIED

THE BOEING COMPANY

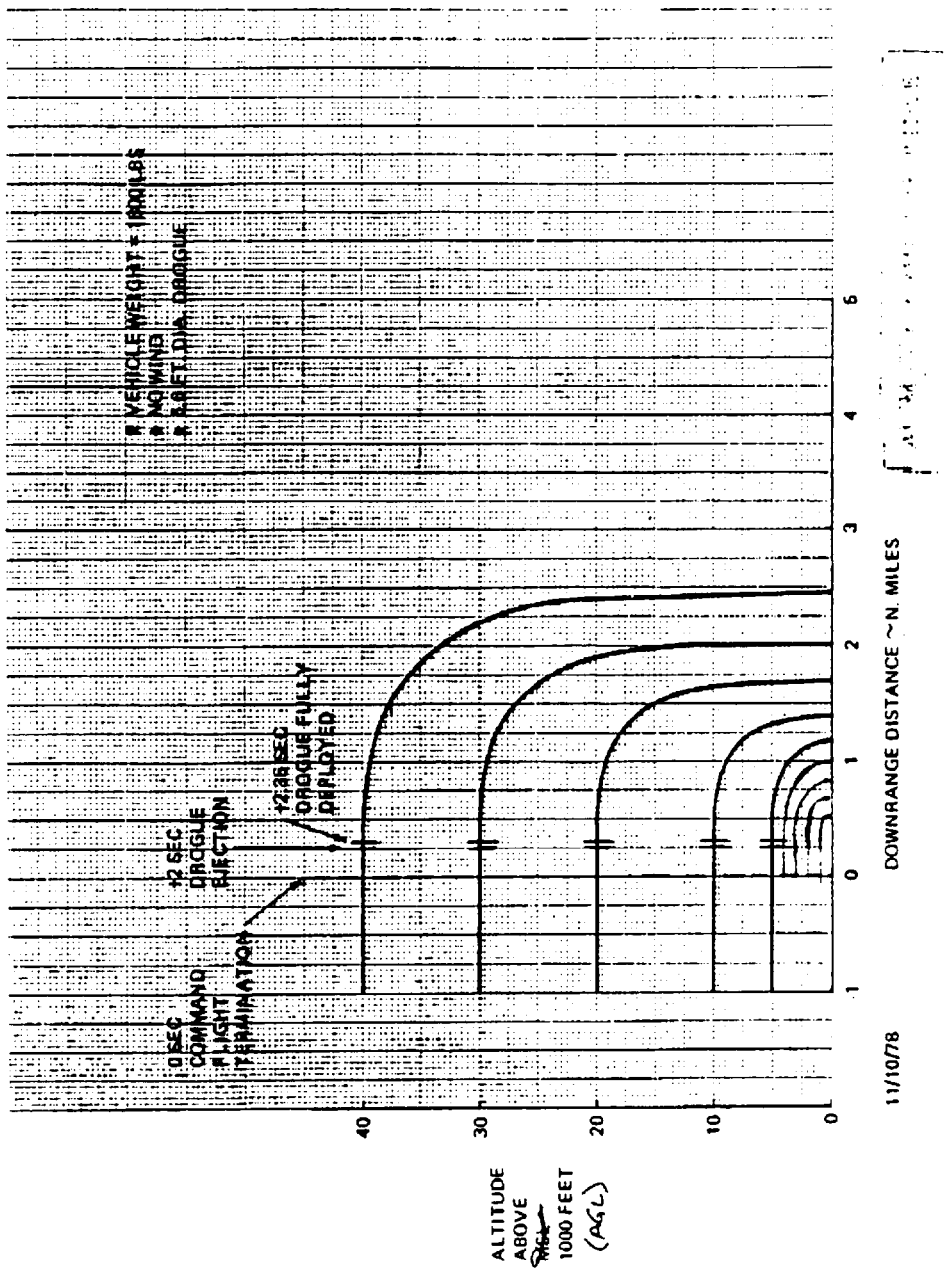


Figure 3.1-9. Flight Termination Trajectory Profiles at Empty Weight

UNCLASSIFIED

SUMMARY and CONCLUSION

As described in the preceding sections of this report, there is a comprehensive and controlled process in place the governs testing of cruise missiles on the Utah Test and Training Range, all of which are to ensure tests are safe and avoid potential damage to people, facilities or structures. In summary:

(1) Cruise Missile Tests are methodically planned events with safety as a primary consideration throughout the process.
(2) Formal approval reviews are conducted prior to the execution of each test to ensure thoroughness of all mission and contingency plans.
(3) All test cruise missiles are fitted with a Flight Termination System (FTS) capable of being used to take manual control of a missile when needed to redirect it, or to immediately terminate its flight should that be required. No FTS failure has ever occurred.
(4) All cruise missile test flights are conducted with a number of supporting aircraft in company with the cruise missile to observe its flight (eyeball contact). In addition, telemetry is continuously monitored by airborne and ground control stations to observe all operating parameters of the test missile. With the ability to detect incipient problems, these monitoring stations are able to take preventive actions should such be warranted.
(5) Cruise missiles fly pre-programmed routes with high navigation accuracy. In instances where cruise missiles have failed in flight, impact has been within ¼ mile of the planned flight path,
(6) In the UTTR, cruise missile flight paths are required to remain clear of manned facilities (e.g. the PFSF) by 3 miles.
(7) Cruise missile flight trajectories are tangential (as opposed to radial) to the PFSF, with a point of approach no closer than 10 nm from the facility.

Conclusion

The processes and procedure in place ensure that any flight failure of a cruise missile under test on the UTTR is highly unlikely to encroach on the ISFSI site. The separation geometry and FTS activation parameters will ensure that any failed missile lands within the UTTR controlled airspace boundaries, clear of known manned sites.

ASSESSMENT: Extremely low risk to the ISFSI from a cruise missile test on UTTR

DEFINITIONS

Captive Carry:

- Captive Carry refers to the time that a missile is attached to an aircraft, and can be for an entire flight or for a partial flight in preparation for launch. A total captive carry mission is one in which the missile is purposely held on the launch aircraft pylon for the entire test mission. This is typically done to verify the mission profile sequence interface hardware and software. Additionally, the missile mission computer can be coupled to the mother ship's autopilot to allow the missile navigation set to fly the mission profile while still attached to and directing the maneuvers of the launch aircraft. In this scenario no launch is ever attempted. A second definition of captive carry refers to that portion of the test mission in which the missile is attached to the launch platform. In this scenario, a missile launch is planned and as such captive carry refers to only that portion of the test mission during which the missile is actually mated to and communicating with the launch aircraft. The captive carry portion of the mission ends when the missile departs the pylon

Restricted Areas:

- An area (land, sea, or air) in which there are special restrictive measures employed to prevent or minimize interference between friendly forces or an area under military jurisdiction in which special security measures are employed to prevent unauthorized entry.
- Airspace within which the flight of aircraft, while not wholly prohibited, is subject to restriction. IFR of VFR operations in the area may be authorized by the controlling air traffic control facility when it is not activated by the using agency.
- An area that must contain all "Hazardous Activity" as defined by branch of service for specific type of aircraft using the range.

Military Operating Areas (MOAs):

- Special use airspace allocated to the military to separate/segregate certain military activities from Instrument Flight Rules (IFR) traffic and to identify for Visual Flight Rules (VFR) traffic where these activities are conducted.

Special Use Airspace:

- Airspace of defined dimension wherein activities must be confined because of their nature, and/or wherein limitations may be imposed upon aircraft operation that are not part of those activities.

EXHIBIT 4
Wagner/Girman Declaration

3.0 FLIGHT SAFETY ANALYSIS

3.1 FLIGHT TERMINATION FOOTPRINTS

Safety action that results in premature flight termination will produce two major pieces and many small lightweight pieces of debris. The heaviest segment consists of the intact air vehicle suspended below a large drogue parachute. The other major piece is the Flight Termination System (FTS) compartment cover attached to a pilot chute. Minor pieces of debris are ejected by the cover removal thrusters in the form of small diameter steel locking balls. Characteristics of these pieces are contained in Figure 3.1-1.

The FTS deployment timing sequence used in the foot print analysis is shown below:

TIME (SEC.)	EVENT
0	Command Flight Termination
2.0	Compartment Cover Jettision Drogue Chute Ejection Fuel Valve Closed
2.35	Drogue Fully Deployed

Any additional engine run time after fuel valve closure will have negligible effect on the footprint. The initial drogue chute decelerating force exceeds maximum engine thrust by a factor ranging from 15 to 30. Also, engine flameout will occur due to inlet airflow distortion when the drogue force upsets the air vehicle pitch attitude.

Trajectory profiles for the air vehicle and drogue chute in the absence of winds are shown in Figures 3.1-2 and 3.1-3 for the air vehicle at launch weight and near empty weight. Initial conditions at the point of flight termination represent launch speed at high altitudes and high speed cruise at the lower altitudes. Profiles for the FTS compartment cover are not shown because the downrange distance is small.

Figure 3.1-4 presents impact footprints of the air vehicle and drogue chute for the two extremes of air vehicle weight. Corresponding footprints are shown in Figure 3.1-5 for the FTS compartment cover and pilot chute. Initial altitudes are typical of a high altitude launch, mid-altitude launch (or cruise) and low altitude cruise. Impact dispersions are computed with a 50 knot average wind velocity that is assumed to be from any direction.

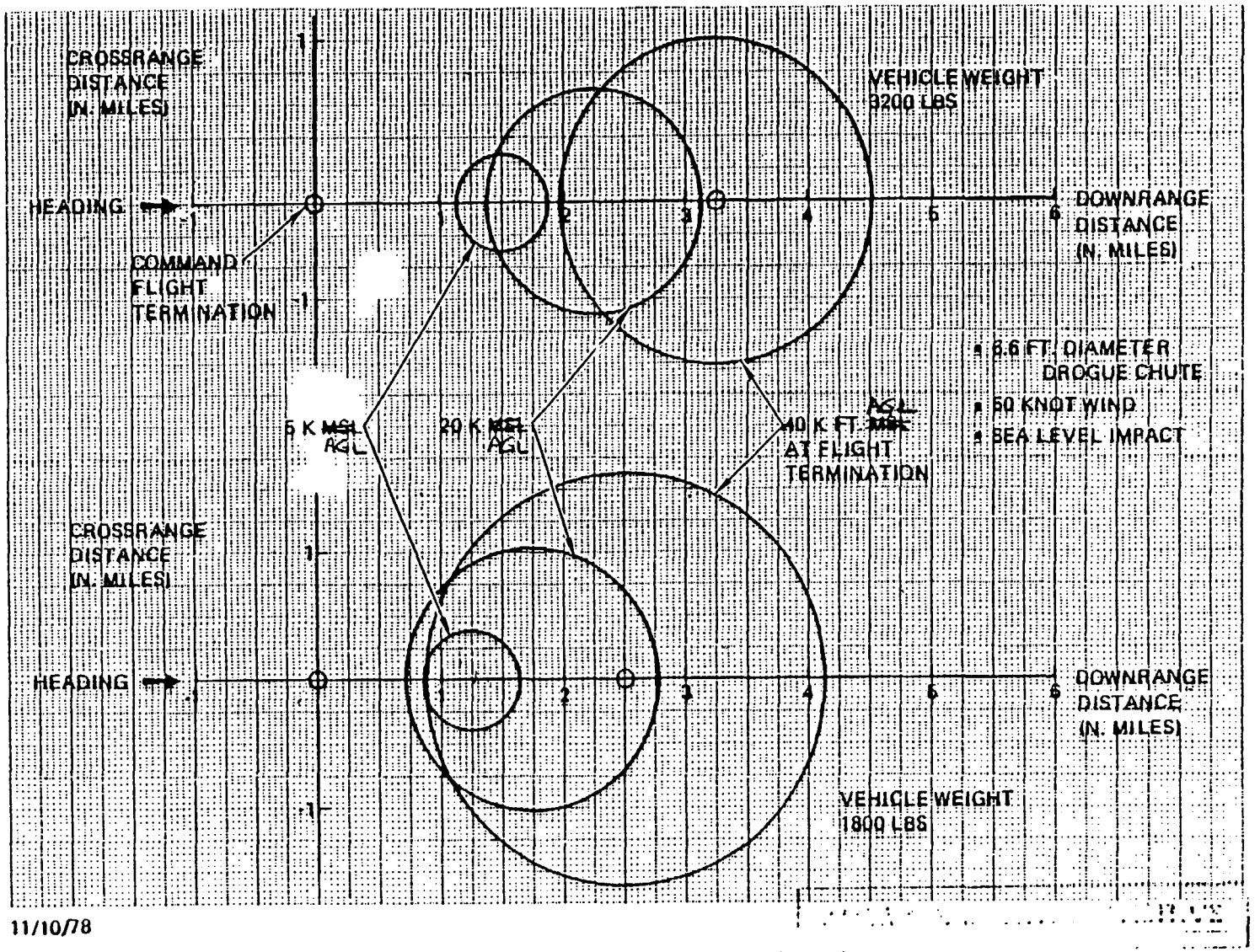


Figure 3.1-4. Air Vehicle Missile Impact Footprints

UNCLASSIFIED

THE BOEING COMPANY

EXHIBIT 5
Wagner/Girman Declaration

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

EXHIBIT 5 WAGNER/GIRMAN DECLARATION

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: NONE

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	

DECLARATION OF JAMES L. COLE, JR.,
WAYNE O. JEFFERSON, JR., AND RONALD E. FLY

James L. Cole, Jr., Wayne O. Jefferson, Jr., and Ronald E. Fly state as follows under penalties of perjury:

I. WITNESSES

A. James L. Cole, Jr.

1. I am Senior Director, Safety of the Air Transport Association and an associate with Burdeshaw Associates, Ltd. Burdeshaw Associates is a consulting firm in the Washington, D.C. area that provides services to clients in the areas of aviation, transportation, military operations, and government affairs. In 1994 I retired from the United States Air Force with the rank of Brigadier General. I am providing this declaration in support of a motion for summary disposition of Contention Utah K in the above captioned proceeding to indicate the risk of aircraft or air-delivered ordnance accidents impacting the proposed Private Fuel Storage Facility (PFSF) for the storage of spent nuclear fuel in Skull Valley, Utah.

2. My professional and educational experience is summarized in the curriculum vitae attached as Exhibit 1 to this declaration. I have extensive experience in and

knowledge of aircraft operations and aviation safety. From 1991 to 1994, I served as Chief of Safety of the United States Air Force and directed the entire USAF safety program. I was responsible for accident prevention and investigation in all aspects of ground and air operations. I was also commander of the 89th Airlift Wing (which transports the President of the United States) and vice commander of a C-141 wing. I have 6,500 total flying hours with 3,000 flying hours in heavy jet aircraft. I was also an instructor pilot and flight examiner (check pilot) in the C-141 aircraft.

3. I was responsible for PFS's assessment of the risk to the PFSF posed by aircraft crashes and ordnance impacts, with respect to, generally speaking, overall aviation safety, data and information concerning military and civilian air traffic in the region of the PFSF and aircraft accident rates, and all aspects of civilian aviation. I also reviewed in depth the Air Force's mishap reports for the F-16 for the ten year period from FY1989 through FY1998. During over three years as USAF Chief of Safety, I personally reviewed and approved every Air Force Accident Safety Investigation report for all types of aircraft. On all relevant aspects of the assessment I provided my judgment regarding pilot actions and responses to emergencies.

B. Wayne O. Jefferson, Jr.

4. I am an associate with Burdeshaw Associates, Ltd. In 1989 I retired from the United States Air Force with the rank of Major General. I am providing this declaration in support of a motion for summary disposition of Contention Utah K in the above captioned proceeding to indicate the risk of aircraft or air-delivered ordnance accidents impacting the proposed PFSF for the storage of spent nuclear fuel in Skull Valley, Utah.

5. My professional and educational experience is summarized in the curriculum vitae attached as Exhibit 2 to this declaration. I have extensive experience in and knowledge of U.S. Air Force aircraft operations and weapons testing and training operations. I served in the Air Force for over 30 years, including service with the Strategic Air Command as a B-52 wing commander. I have 4,450 flying hours in 9 different aircraft

types. My experience also includes service in senior positions on the Air Staff, Joint Staff and on the faculty of the U.S. Air Force Academy. Since I retired from the Air Force I have been a consultant in management, management training, and quantitative probabilistic analysis. My education includes a master's degree in operations research and a master's in business administration.

6. I was responsible for PFS's assessment of the risk to the PFSF posed by aircraft crashes and ordnance impacts, with respect to, generally speaking, the quantitative calculations PFS performed concerning the probability that a crashing aircraft would impact the PFSF. I also reviewed in depth the Air Force's mishap reports for the F-16 for the ten year period from FY1989 through FY1998. On all relevant aspects of the assessment I provided my judgment regarding pilot actions and responses to emergencies.

C. Ronald. E. Fly

7. I am an associate with Burdeshaw Associates, Ltd. In 1998 I retired from the United States Air Force with the rank of Colonel. I am providing this declaration in support of a motion for summary disposition of Contention Utah K in the above captioned proceeding to indicate the risk of aircraft or air-delivered weapon accidents impacting the proposed PFSF for the storage of spent nuclear fuel in Skull Valley, Utah.

8. My professional and educational experience is summarized in the curriculum vitae attached as Exhibit 3 to this declaration. I have extensive experience in and knowledge of U.S. Air Force aircraft operations and training operations. I served in the Air Force for 24 years as an F-16 pilot, instructor, and wing commander. I have approximately 1,200 flying hours in the F-16 as a pilot and instructor. From 1997 to 1998 I served as Commander of the 388th Fighter Wing at Hill Air Force Base, Utah, during which time I flew F-16s on the UTTR. I was also Commander of the UTTR beginning Oct. 1, 1997 when the range was transferred to the 388th FW from Air Force Material Command. In addition to my flight operations and training operations experience, I also have experience in strategic planning, operational analysis, international affairs, space

operations, and logistical support. Furthermore, I am specifically knowledgeable about the operations of military and civilian aircraft that fly in and around Skull Valley, Utah, including the military aircraft that fly from Hill Air Force Base and on or around the UTTR and Dugway.

9. I was responsible for PFS's assessment of the risk to the PFSF posed by aircraft crashes and ordnance impacts, with respect to, generally speaking, military aircraft operations on and around the UTTR and F-16 emergency procedures. I reviewed in depth the Air Force's mishap reports for the F-16 for the ten year period from FY1989 through FY1998. On all relevant aspects of the assessment I also provided my judgment regarding pilot actions and responses to emergencies.

II. BACKGROUND

10. In the bases for Contention Utah K, as admitted by the Licensing Board, the State asserts in part that Applicant Private Fuel Storage (PFS) inadequately considered the hazard to the PFSF of credible accidents involving materials or activities at or emanating from Salt Lake City International Airport, Hill Air Force Base, the UTTR, and Dugway (which is the location of Michael Army Airfield). We have reviewed information and data concerning the potential hazard to the PFSF from aircraft crashes and the use of air-delivered weapons in testing and training at these facilities and have determined that they pose no credible or significant hazard to the PFSF. Our assessment is set forth in a formal report attached as Exhibit 4, entitled, "Private Fuel Storage, Aircraft Crash Impact Hazard at the Private Fuel Storage Facility," Revision 4 (August 10, 2000) ("Aircraft Report"). Our analysis and the conclusions from the report are summarized in Part III below.

11. As part of our assessment, we reviewed all of the available Air Force F-16 Class A Mishap Aircraft Accident Investigation Reports from the period fiscal year 1989

through fiscal year 1998.[1] Those reports are prepared under Air Force Instruction 51-503 after each aircraft mishap to determine the cause of the accident for the purposes of preserving all available evidence and providing a complete factual summary for use in claims, litigation, disciplinary actions, adverse administrative proceedings, and other purposes in accordance with AFI 51-503. The reports follow a set format which sets forth the details of the circumstances surrounding the accident, including: a summary of the history of the flight, the flight mission, preflight activities and planning, the actual flight activity, crash impact information, the functioning of the emergency escape mechanism, rescue activity, maintenance and mechanical factors, supervisory factors, pilot qualifications and performance, navigational aids and facilities, weather, and pertinent directives and publications. Each report may conclude with a statement of opinion by the investigating officer as to the cause of the accident. The flight activity section in particular gives the relevant information as to pilot actions after the emergency begins, including efforts to avoid populated areas and built up structures on the ground. By obtaining these reports, PFS has been able to determine the causes of F-16 accidents likely to occur in Skull Valley and on the UTTR. In total, we reviewed 126 accident reports, covering mishaps in which 121 F-16s were destroyed.

12. In recent responses to PFS discovery requests, the State of Utah has taken issue with some aspects of our assessment. In Part IV of this declaration we respond to the State's specific challenges.

III. SUMMARY OF AIRCRAFT CRASH IMPACT HAZARD ASSESSMENT

A. Aviation Activity in the Vicinity of the PFSF in Skull Valley

13. The PFSF site is located in Skull Valley, Utah, approximately 50 miles southwest of Salt Lake City. Aviation activity in the vicinity of the site consists of mili-

[1] A Class A mishap is one in which there is a fatality, the aircraft is destroyed, or the aircraft suffers $1 million in damage or more.

tary operations, associated with the UTTR and Michael Army Airfield, and civilian commercial and potentially general aviation. The UTTR is an Air Force training and testing range. The airspace over the UTTR extends somewhat beyond the range's land boundaries and is divided into restricted areas, over which the airspace is restricted to military operations, and military operating areas (MOAs). The MOAs on the UTTR are located on the edges of the range, adjacent to the restricted areas. A MOA constitutes airspace of defined dimensions allocated to the military to separate or segregate certain military activities from other flight operations.

14. The UTTR airspace is shown on the map attached as Exhibit 5. It is divided into a North Area, located on the western shore of the Great Salt Lake, north of Interstate 80, and a South Area, located to the west of the Stansbury Mountains, south of Interstate 80. The area covered by the airspace of the UTTR South Area is roughly 148 miles long (at its longest point) by 102 miles wide (at its widest point). The PFSF site is located over 18 statute miles east of the eastern land boundary of the UTTR South Area and 8.5 statute miles northeast of the northeastern boundary of Dugway Proving Ground. The site lies within the Sevier B MOA, two statute miles to the east of the edge of UTTR restricted airspace. As shown on Exhibit 5, the area covered by the airspace of the Sevier B MOA is roughly 145 miles long and, in the vicinity of the PFSF site, is roughly 12 miles wide.

15. Military air operations in the vicinity of Skull Valley consist of the following:

- U.S. Air Force F-16 fighter aircraft transiting Skull Valley en route from Hill AFB to the UTTR South Area. Some F-16 flights carry military ordnance.
- F-16s from Hill and other military aircraft of various types conducting training exercises on the UTTR.
- F-16s from Hill occasionally returning from the UTTR South Area to Hill via the Moser Recovery Route, which runs to the northeast, 2-3 miles north of the PFSF site.

- Military aircraft, comprising mostly large transport aircraft, flying on military airway IR-420, to and from Michael Army Airfield, located on DPG, about 17 miles southwest of the PFSF.

Aircraft Report at 1.

16. Civilian aircraft flying in the vicinity of Skull Valley consist of the following:

- Aircraft flying on Federal airway J-56, which runs east-northeast and west-southwest about 12 miles north of the PFSF site.[2]
- Aircraft flying on airway V-257, which runs north and south about 20 miles east of the site.
- General aviation activity, which has not been reported but conceivably may occur in the area.

Aircraft Report at 1.

17. We have grouped the aircraft flying in and around Skull Valley that could potentially pose a hazard to the PFSF in the event of an accident as above. We have calculated the annual crash impact probabilities for the PFSF for each group of aircraft and the probability that ordnance carried on a military aircraft (separate from the aircraft itself) would impact the PFSF. The annual crash impact probability that we have calculated is less than 1 E-6/year.

B. F-16 Aircraft Transiting Skull Valley

1. Aircraft Crash Hazard

18. F-16 fighter aircraft fly north to south down Skull Valley, within Sevier B MOA, en route from Hill AFB to the UTTR South Area. The F-16s use the eastern side of Skull Valley as their predominant route of travel and typically pass approximately five miles to the east of the PFSF site. The U.S. Air Force has indicated that the F-16s typi-

[2] Commercial air traffic to and from Salt Lake City International Airport, including business jets, flying through the region around the PFSF is included in the traffic on J-56 and V-257.

cally fly between 3,000 and 4,000 ft. above ground level (AGL), with a minimum altitude of 1,000 ft AGL at approximately 350 to 400 knots indicated airspeed (KIAS). In Fiscal Year 1998, 3,871 such flights passed through Skull Valley. Aircraft Report at 5-6.

19. It is not credible that a crashing F-16 would impact the PFSF. F-16s use the airspace above Skull Valley primarily as a transition corridor to the UTTR. Typically F-16s will start a descent into the low altitude arena (below 5,000 ft. above ground level (AGL)) and spread out in a tactical formation which may be 2-3 nautical miles across. Formations vary depending on the number of aircraft in the flight, meteorological conditions, mission objectives, etc. In addition, the F-16s may accelerate to above 400 KIAS and perform two 90° G-awareness turns. Typical maneuvering in Skull Valley is in the administrative and routine categories, both of which are low risk phases of flight (compared to aggressive maneuvering in restricted areas, which is higher risk) . Furthermore, by far the most likely cause of an accident in Skull Valley would be an engine failure, which would leave the pilot in control of the aircraft. Air Force pilots are instructed to avoid ground facilities in the event of a mishap in which the pilot retains control of the direction of the aircraft. Thus, the pilot of an F-16 that had suffered an engine failure would be able to direct the aircraft away from the PFSF before ejecting. Nevertheless, we calculated the probability that an F-16 transiting Skull Valley would crash and impact the PFSF.

20. We calculated the probability that an F-16 transiting Skull Valley would crash and impact the PFSF using the following equation:

$P = C \times N \times A / w$, where

P = probability per year of an aircraft crashing into the PFSF
C = in-flight crash rate per mile
N = number of flights per year along the airway
A = effective area of the PFSF in square miles
w = width of airway in miles

Aircraft Crash Report at 6-8.

21. To calculate the F-16 impact probability, the Sevier B MOA airspace in the vicinity of the PFSF was treated as an airway with a width of 10 statute miles. Id. at 16. Given the flight characteristics of the F-16, the region within PFSF where the storage casks are located has an effective area of 0.1337 sq. mi., assuming a facility at full capacity with 4,000 spent fuel storage casks on site. Id. at 13-16. The number of normal flights through the valley was taken to be 3,871 per year. Id. at 8. The crash rate for the F-16 flight was calculated from Air Force data to be 2.736 E-8 per mile. Id. at 8-13. We also determined, from an extensive review of Air Force F-16 accident investigation reports over a 10-year period, that over 90 percent of the F-16 crashes that would result from accident-initiating events that could occur in Skull Valley would leave the pilot in control of the aircraft after the event. Id. at 16-18, Tab H.

22. Furthermore, because of the training Air Force pilots receive in responding to such in-flight events, the flight characteristics of the F-16, the absence of other built up areas in Skull Valley, and the small effort required for the pilot to avoid the PFSF site in the event of a crash caused by an accident-initiating event leaving him in control of the aircraft, the pilot would be able to direct the aircraft away from the PFSF at least 95 percent of the time in which such an event caused a crash in Skull Valley. Id. at 18-23. Review of the F-16 accident reports showed a number of instances in which pilots maneuvered their aircraft to avoid sites on the ground after an accident-initiating event. The accident reports showed no cases, however, in which the pilot had control of the aircraft and time but failed to guide his aircraft so as to minimize damage to a facility or populated area on the ground. Therefore, based on this data, the assumption that pilots would fail to avoid the PFSF 5 percent of the time is a very conservative upper bound; the data would support assigning a percentage of near zero. Id. Tab H at 28 n.22.

23. Accordingly, conservatively, 85.5 percent (90% x 95%) of the crashing F-16s would be able to avoid the PFSF. Hence the calculated crash impact hazard to the PFSF would be reduced by this fraction. See id. at 23a-24.

24. Based on the above, the annual crash impact probability for F-16s transiting Skull Valley (assuming a fully loaded facility) was calculated in the Aircraft Report to be 2.05 E-7 based on the 3,871 flights F-16 in Fiscal Year 1998. Id. at 24-25. PFS, however, recently requested and has just received data from Hill AFB on the number of F-16s transiting Skull Valley en route to the south part of the UTTR for Fiscal Years 1999 and 2000. For Fiscal Year 1999, 4,250 F-16s transited Skull Valley and for Fiscal Year 2000, 5,757 F-16s transited Skull Valley.

25. The change in the number of F-16 sorties represents in part normal fluctuations in the number of sorties flown annually as well as certain changes in Air Force operations. In 1998, the Air Force announced a new policy for overseas and other deployments of Air Force units away from their home bases, implemented through the Air Expeditionary Force (AEF) concept. Under the AEF concept, portions of various Air Force squadrons are assigned to an AEF on a regular basis for overseas or other deployment as needed. Under the AEF concept, units are on call for deployment for 90 days over a 15-month period. The purpose is to make more equal and regular the deployment of Air Force units from their home base of operations. The goal is to provide a more stable and predictable operating cycle and control and reduce the amount of time spent away from the home base of operations.

26. Therefore, based on this new data it is appropriate to increase the number of F-16 sorties transiting Skull Valley on an annual basis. The three year average for Fiscal Years 1998-2000 is 4,626 sorties per year. This number may, however, understate the ongoing impact of the AEF concept, introduced in 1998. By the same token, it would not be appropriate to use the Fiscal Year 2000 number by itself. As stated, the AEF is on a 15-month rotation so there will be fluctuations from year to year on this basis alone. Overseas deployments would reduce sortie rates, as fewer aircraft would be at Hill AFB. For example, in 1999 the Air Force deployed a significant number of aircraft to the conflict in Kosovo. In addition, even if the 388th Fighter Wing were not deployed overseas, some of its aircraft might be temporarily deployed to other locations in the United States

to replace units that were sent overseas. The United States was not involved in an international crisis like the Kosovo conflict in FY2000. UTTR sortie rates in future years, in which there was such a crisis, would therefore be expected to be lower than those in FY2000. In these circumstances, we believe that taking into account the recent increases in sorties, an appropriate and reasonable number of F-16 sorties to assume on an annual basis transiting Skull Valley would be an average of the FY1999 and FY2000 numbers, or approximately 5,000.[3]

27. In addition to the F-16s at Hill AFB flying more sorties, in its recent discovery responses, the State claimed that additional F-16s are to be stationed at Hill. The number of authorized F-16s for the 388th Fighter Wing at Hill AFB has been 54 and we have been advised that this number is scheduled to increase by 12 to 66. Further, the 419th reserve wing consisting of 15 authorized F-16s are still stationed, as previously, at Hill AFB. It would be reasonable to assume a proportional increase in the number of sorties resulting from the additional authorization. The total number of authorized aircraft at the base will increase from 69 (54 + 15) to 81 (66 + 15), which is a 17.4% increase.

28. Therefore, the annual number of sorties would increase by 17.4%, from 5,000 to 5,870 to account for the increase in the number of F-16s stationed at Hill AFB. Accordingly "N" in the equation set forth in paragraph 20 above would become 5,870 instead of 3,871. This in turn would increase the annual crash impact probability for F-16s transiting Skull Valley (assuming a fully loaded 4,000 cask facility) to 3.11 E-7. While F-16 sortie rates were higher in FY1999 and FY2000 than they were in FY1998 and FY1999, the Federal Aviation Administration has projected that the number of military flights in the United States overall would not increase in the period from 1998 to

[3] This includes the last year in which there was a significant military operation overseas and the most recent year without one.

2025.[4] Therefore, we would not expect the sortie rate at Hill AFB or on the UTTR to increase significantly beyond the FY1999 and FY2000 rate.[5]

2. Jettisoned Ordnance Hazard

a. Direct Impact

29. The U.S. Air Force has specifically stated that "no aircraft flying over Skull Valley are allowed to have their armament switches in a release capable mode. All switches are "SAFE" until inside DOD land boundaries." Aircraft Report at 77. The Air Force has also stated that "the UTTR has not experienced an unanticipated munitions release outside of designated launch/drop/shoot boxes" Id. During FY 1998 there were 13,367 total sorties in the UTTR with 5,083 in the North and 8,284 in the South; in earlier years, during the Cold War, the sortie rate was higher; e.g., 27,000 sorties were flown on the UTTR in FY1988. Id. All were accomplished with obviously no inadvertent munitions releases outside of designated launch/drop/shoot boxes. Consequently, the likelihood or probability of an inadvertent weapons release from F-16s flying over Skull Valley impacting or affecting the PFSF is as a practical matter zero.

30. We did calculate, however, a probability for ordnance jettisoned from a crashing F-16 in Skull Valley that could potentially impact the PFSF. Aircraft Report at 79-83. Some of the F-16 flights through Skull Valley carry ordnance (live or inert). In the event of an incident leading to a crash in which the pilot would have time to respond before ejecting from the aircraft (e.g., an engine failure), one of the pilot's first actions would be to jettison any ordnance carried by the aircraft. Id. at 79. We used an approach

---

[4] Federal Aviation Administration, Office of Aviation Policy and Plans, FAA Long-Range Forecasts, Fiscal Years 2015, 2020, and 2025, FAA-APO-99-5 (June 1999).

[5] As an excursion, PFShas examined the use of the FY2000 count of 5757 F-16 sorties in Skull Valley as the norm and adjusted it upward by 17.4% to 6759 sorties as the new steady state rate. While we do not believe this rate is likely to be the steady state rate, using it increases the Skull Valley F-16 impact probability from 3.11×10^{-7} to 3.58×10^{-7}, and the Jettisoned Military Ordnance probability from 1.49×10^{-7} to 1.71×10^{-7}. Adjusting the Moser Recovery probability by its same factor brings it upfront 2.00×10^{-8} to 2.30×10^{-8}. This is not significant in the total calculation.

similar to the approach described above for calculating the aircraft impact probability to calculate the probability that jettisoned ordnance would impact the PFSF. See id. at 79-82. Specifically, we calculated the probability, P, that the ordnance would impact the PFSF using the equation $P = N \times C \times e \times A/w$, as described in the paragraph below. Id.

31. The fraction of the 3,871 F-16s transiting Skull Valley per year that would be carrying ordnance that could be jettisoned was determined from data provided by Hill AFB to be 11.8 percent. Id. at 82. Thus the number of aircraft carrying live or inert ordnance through Skull Valley per year, N in the equation above, would be 457. See id. The crash rate for the F-16s, C, was taken to be 2.736 E-8 per mile, as above. Id. Nonetheless, the pilot was assumed to jettison ordnance in only 90 percent of all crashes, the fraction of the crashes, e, assumed to be attributable to engine failure or some other event leaving him in control of the aircraft (in crashes attributable to other causes it was assumed that the pilot would eject quickly and would not jettison ordnance). Id. Skull Valley was treated as an airway with a width, w, of 10 statute miles.

32. As with the calculation for F-16s transiting Skull Valley, we conservatively assumed that the F-16s are uniformly distributed across the 10 miles, despite the fact that their predominant route of flight is down the eastern side of the valley. The area of the PFSF, from the perspective of ordnance jettisoned from an aircraft flying from north to south over the site, A, was taken to be the product of the width and the depth of the cask storage area (assuming a full facility with 4,000 casks) plus the product of the width and depth of the canister transfer building, in that pieces of ordnance are small relative to an aircraft and impact the ground at a steep angle. Id. at 80 & n.82, 82. Thus, the area of the PFSF was calculated to be 0.08763 sq. mi. Id. at 82. Therefore, using the equation $P = N \times C \times e \times A/w$, the probability that jettisoned ordnance would impact the PFSF is calculated as follows:

$$P = 457 \times 2.736\text{ E-8} \times 0.90 \times 0.08763 / 10 = 9.85\text{ E-8}$$

Id. at 82-83.

33. If we assume that the number of sorties carrying ordnance through Skull Valley would increase in proportion to the total increase in sorties due to greater usage of the UTTR and an increase in the number of aircraft at Hill AFB, then this probability would increase by a factor of 5,870/3,871, or 1.516. Therefore, the new probability would be 1.49 E-7.

b. Near Impact and Explosion

34. In addition to the potential hazard posed by direct impacts of crashing aircraft and jettisoned ordnance, we also calculated the hazard to the PFSF posed by jettisoned live ordnance that might land near the facility and explode on impact, as well as the hazard posed by a potential explosion of live ordnance carried aboard a crashing aircraft that might impact the ground near the PFSF. Aircraft Report at 83a-83l. At the outset, as stated above, Air Force pilots do not arm the live ordnance they are carrying while transiting Skull Valley near the PFSF. Id. at 83a. Furthermore, the U.S. Air Force has indicated that the likelihood that unarmed live ordnance would explode when impacting the ground after being jettisoned is "remote" and the Air Force has no records of such incidents in the last 10 years. Id. at 83b, Tab Q. Thus, it is highly unlikely that jettisoned live ordnance or live ordnance carried aboard a crashing aircraft that did not directly impact the PFSF would damage the facility.

35. Nevertheless, to calculate a numerical hazard to the facility, we assumed that such ordnance would have a 1 percent chance of exploding and assessed that damage to the PFSF that would result if an explosion occurred close enough so that the blast overpressure would damage a storage cask or the Canister Transfer Building, without hitting either one. Id. at 83g-83i. The explosive overpressure limit for a storage cask was taken to be 10 psi. Id. at 83b-83c. The limit for the Canister Transfer Building was taken to be 1.5 psi. Id. at 83c. We assumed that the ordnance in question was a 2,000 lb. bomb, the largest single piece of ordnance carried by the F-16s that transit Skull Valley. Id. at 81, 83j. Based on information provided by Hill AFB, approximately 193 F-16s transited Skull Valley in 1998 with live ordnance. Id. at 83h. We calculated the prob-

ability that an F-16 carrying live ordnance would jettison the ordnance so as to impact near the PFSF, or crash near the PFSF without jettisoning the ordnance, following the same method we used to calculate the probability that an F-16 would crash and impact the facility. The results of our final calculation showed that the annual probability that a storage cask or the Canister Transfer Building would be damaged by an explosion of live ordnance jettisoned from a crashing aircraft or carried aboard a crashing aircraft that impacted the ground near the PFSF was equal to 2.43 E-10. Id. at 83k-83l. This is exceedingly low and is insignificant relative to the other aircraft crash and jettisoned ordnance impact hazards calculated for the PFSF. Even if the probability is increased to reflect additional sorties transiting Skull Valley, it remains negligible.

C. Aircraft Conducting Training on the UTTR

36. According to the Air Force, 8,284 sorties were flown over the UTTR South Area in 1998. Aircraft Report at 28. Those aircraft conducted a variety of activities, including air-to-air combat training, air-to-ground attack training, air-refueling training, and transportation to and from Michael Army Airfield (which is located beneath UTTR airspace). Id. at 29. Hazards posed by aircraft flying to and from Michael Army Airfield on Dugway are addressed separately below.

1. Potential Aircraft Impacts

37. Aircraft conducting air-to-ground attack training do so over targets that are located more than 20 miles from the PFSF site and aircraft conducting air refueling training do so on the far western side of the UTTR, over 50 miles from the site. Id. at 29-32. Thus, by virtue of their distance from the PFSF, such aircraft do not pose a crash impact hazard to the facility. Id. Fighter aircraft conducting air to air combat training conduct their aggressive, higher risk maneuvering toward the center of the restricted areas on the UTTR, well over 10 miles from the PFSF. Thus, as a practical matter, those aircraft also do not pose a crash impact hazard to the facility. Nevertheless, we calculated a conservative upper bound probability that fighter aircraft conducting air to air combat training on the UTTR would crash and impact the PFSF.

38. The Air Force indicated 6,360 fighter sorties were flown on the UTTR South Area in 1998 and one-third, or approximately 2,120, involved fighter aircraft conducting air-to-air training. Aircraft Report at 34.

39. The crash impact probability for fighter aircraft conducting air-to-air training on the UTTR was calculated as follows:

$P = C_a \times A_c \times A/A_p \times R$, where

P = annual crash impact probability
C_a = total air-to-air training crash rate per square mile on the UTTR
A_c = the area of the UTTR from which aircraft could credibly impact the PFSF in the event of a crash
A = effective area of the PFSF in square miles
A_p = the footprint area, in which a disabled aircraft could possibly hit the ground in the event of a crash
R = the probability that the pilot of a crashing aircraft would be able to take action to avoid hitting the PFSF

Aircraft Report at 32-33.

40. The total air-to-air training crash rate per square mile on the UTTR, C_a, was calculated from the total number of hours flown in air-to-air training on the UTTR South Area (2,468), the crash rate per hour for fighter aircraft (the F-16) in combat training (3.96 E-5), the distribution of air operations over the sectors of the UTTR nearest the PFSF, and the ground areas of those sectors. Aircraft Report at 34a-37d. As with the F-16s transiting Skull Valley, 95 percent of the crashes on the UTTR attributable to engine failure or some other cause leaving the pilot in control of the aircraft were determined not to pose a hazard to the PFSF, in that the pilot would retain control of the aircraft and would be able to avoid the site. Id. at 42-43. Based on Air Force data, 45 percent of all F-16 crashes occurring during combat training are attributable to engine failure; thus the factor R in the equation above was calculated to be 1-(45% x 95%), or 0.573. Id.

41. The area from which an aircraft could credibly impact the PFSF in the event of a crash, A_c, was taken to be the portion of the UTTR within 10 miles of the PFSF and outside a three-mile buffer zone assumed to exist on the edge of the UTTR restricted

areas. Id. at 37d-39c. A crashing aircraft more than 10 miles from the PFSF would have to be under control of the pilot in order to glide and reach the site, and the pilot would guide any such aircraft away from the site, which is outside the land boundaries and the restricted airspace of the UTTR. Id. at 37d-39. The buffer zone represents the fact that aircraft rarely fly within three miles of the edges of the restricted areas while conducting training on the UTTR. Id. at 37c-37d, 39. For the purposes of calculation, potential aircraft crashes during air to air combat training were assumed to be evenly distributed over the restricted areas in which the training takes place, outside the buffer zone. This is conservative, in that the aggressive maneuvering, that leads to most mishaps and by far the most mishaps in which the pilot does not retain control of the aircraft, occurs toward the center of the restricted areas, not toward the edges. Hence, most UTTR accidents that would theoretically pose an impact hazard to the PFSF would actually occur too far away for the aircraft to reach the facility. See id. Tab Y.

42. The site effective area, A, was determined as above for a facility at a full capacity of 4,000 storage casks. Id. at 40. The footprint area, A_p, was calculated by assuming that a crashing aircraft could glide in any direction up to a distance equal to the product of its starting altitude above ground and its glide ratio. Id. Accordingly, the aircraft conducting air-to-air training over the UTTR were divided into altitude bands and an impact probability calculated for each band. Id. at 39-42. Aircraft too low to glide to the PFSF in the event of a mishap were calculated not to contribute to the crash impact hazard, in that they would have no chance of reaching the site. Id. at 39a-39b.

43. The maximum annual air crash impact probability for aircraft conducting air-to-air training on the UTTR South Area was calculated from the sum of impact probabilities of the altitude bands to be 7.35 E-8. Id. at 43-43a. If we assume that the total number of fighter sorties on the UTTR would increase in proportion to the increase in F-16 sorties flown from Hill AFB (which is conservative, since not all fighter aircraft that fly on the UTTR are F-16s based at Hill), then this probability would increase by a factor of 1.516, to a probability of 1.11 E-7.

44. Nevertheless, as discussed above, this result is highly conservative, in that the crashes on the UTTR that would leave the pilot without control of the aircraft and the ability to avoid the PFSF would occur toward the center of the restricted area ranges, far from the site. Moreover, while it might be possible for an aircraft to glide 10 miles after an in-flight mishap, it is highly unlikely that a pilot experiencing such a mishap that far from the PFSF would fail to turn his aircraft away from it before ejecting. As the Aircraft Report shows, if it is assumed that a crashing aircraft from the UTTR would glide no more than five miles toward the PFSF, then the hazard posed to the PFSF by UTTR operations would be zero. Id. at 44. Therefore, as a practical matter, the risk to the PFSF from aircraft conducting training on the UTTR is negligible. Indeed, State of Utah witness Lt. Col. Horstman agreed that "if an airplane has a problem up there [on the UTTR], it's not going to make it to Skull Valley, it's going to go to Michael [Army Airfield] or it's going to crash before it gets there, it's that simple." Horstman Dep. at 218.[6]

2. Weapons Use on the UTTR

45. Military aircraft conduct air-to-ground attack training and weapons testing using air-delivered ordnance on the UTTR South Area. Nevertheless, the use of air-delivered ordnance on the UTTR does not pose a potential hazard to the PFSF. See Aircraft Report at 30-32, 76-77. The PFSF site is located to the east of the easternmost land boundary of the range and over 20 miles from the nearest target for air-delivered ordnance on the UTTR. Id. at 28, 30. Weapons use on the UTTR is strictly controlled and, as stated above, the UTTR has never experienced an unanticipated munitions release outside of designated launch/release areas. Id. at 77. Master Arm switches are not actually armed until the aircraft are on the ranges within the UTTR where the bombs are to be dropped. Id. All armament switches are on "safe" until the aircraft are inside DOD land boundaries. Id. Furthermore, the targets on the UTTR are all over 20 miles from the PFSF site and there are no run-in headings for weapons delivery over the Skull Valley

[6] Lt. Col. Hugh Horstman, USAF (Ret.) was named by the State as an expert witness on Contention Utah K.

area. Id. at 30, 76-77. Therefore, weapons use on the UTTR does not pose a hazard to the PFSF.

D. Aircraft Flying on the Moser Recovery

46. Most of the F-16s returning to Hill AFB from the UTTR South Area exit the northern edge of the range (away from the PFSF) in coordination with air traffic control. However, some aircraft returning to Hill from the UTTR South Area may use the Moser recovery route, which runs from the southwest to the northeast, approximately two miles from the PFSF site. Aircraft Report at 48. The Moser route is only used during marginal weather conditions or at night under specific wind conditions which require the use of Runway 32 at Hill AFB. Id. at 48-48a. Based on information from local air traffic controllers, conservatively estimated, the Moser recovery is used by less than five percent of the aircraft returning to Hill. Id. at 48a-49. Indeed, Lt. Col. Horstman stated that Moser was not used at all in 1998. Horstman Dep. at 189-90. He knew of only four flights that used Moser in 1999. Id. at 189. According to the Air Force, 5,726 F-16 sorties were flown on the UTTR South Area in FY98, almost all of which flew from Hill AFB (not all aircraft transit Skull Valley en route to the South Area). Thus, at the very most, fewer than 286 aircraft per year (5% x 5,726) would use the Moser recovery on their return flights. Id. at 49.

47. The average annual crash impact probability for aircraft flying the Moser recovery was calculated using the same method used for calculating the hazard from F-16 flights through Skull Valley. Aircraft Report at 49. The Moser recovery is defined as an airway with a width, w, of 10 nautical miles (11.5 statute miles) (equal to the width of military airway IR-420). Id. The number of aircraft, N, is very conservatively taken to be 286; the crash probability, C, is equal to 2.736 E-8 per mile; the effective area of the site is 0.1337 mi^2; and it is calculated that 85.5 percent of all crashes would be attributable to events leaving the pilot in control of the aircraft, in which the pilot could direct the aircraft away from the PFSF. Id. at 49-49b. Thus, the annual crash impact probability is conservatively estimated to be 1.32 E-8. Id. at 49. If this probability is increased to

reflect the additional sorties flown by F-16s from Hill AFB, it would increase by a factor of 1.516 to 2.00 E-8. But as discussed, PFS's estimate of the number of flights on the Moser recovery was very conservative to begin with.

E. Aircraft Flying to and from Michael AAF on IR-420

48. Michael Army Airfield is located on Dugway Proving Ground, 17 statute miles south-southwest of the PFSF. Aircraft Report at 56. This military airfield has a 13,125 foot runway, and can accommodate all operative aircraft in the Department of Defense inventory, although the majority of the aircraft flying to and from Michael AAF are large cargo aircraft such as the C-5, C-17, and C-141. Id. at 51. The airspace over the Dugway Proving Ground is restricted. Military airway IR-420 terminates north of the PFSF site; aircraft using IR-420 and flying to and from Michael AAF pass in proximity to the site. Id. at 51. The same method used to calculate the hazard to the PFSF from F-16s transiting Skull Valley was used to estimate the probability of an aircraft impacting the PFSF from this airway. Id.

49. NUREG-0800 provides an in-flight crash rate of 4 E-10 per mile for large commercial aircraft, which is appropriate to apply to the types of aircraft flying to and from Michael AAF. Aircraft Report at 51-53. Information provided to PFS by Dugway Proving Ground in 1997 stated that there are approximately 414 flights annually at this airfield. Id. at 55. The effective area of the PFSF is 0.2116 mi^2, calculated for the types of aircraft flying to and from Michael AAF, using the same method as was used to calculate the effective area of the PFSF for an F-16 above. Id. at 53a-54. The width of the airway is 10 nautical miles (nm), or 11.5 statute miles. Id. at 55. The probability of an aircraft impacting the PFSF is therefore 3.0 E-9 per year. Id. Takeoff and landing operations at Michael AAF would pose a negligible hazard to the PFSF because the airfield is over 17 miles from the PFSF. Id. at 56-60. This probability would not increase because of the additional F-16 sorties from Hill AFB, in that the aircraft flying to and from Michael in the direction of IR-420 are not F-16s from Hill.

F. Civilian Aircraft on Airways J-56 and V-257 Including Aircraft Flying to and from Salt Lake City International Airport

50. Airway J-56 runs west-southwest and east-northeast 11.5 statute miles north of the PFSF. Aircraft Report at 62. Airway V-257 runs north and south 19.5 statue miles east of the PFSF. Id. at 66. Traffic on J-56 and V-257 consists of commercial airliners and private business jets, including the traffic to and from Salt Lake City International Airport. Id. at 62, 66. The same method used to calculate the hazard to the PFSF from F-16s transiting Skull Valley was used to estimate the probability of an aircraft impacting the PFSF from both of these airways. Id. at 62, 66.

51. NUREG-0800 provides an in-flight crash rate of 4 E-10 per mile for large commercial aircraft, which is appropriate to apply to the types of aircraft flying on the airways. Aircraft Report at 65. Regional air traffic controllers have stated that fewer than 12 aircraft per day transit each airway. Id. at 62, 66. The effective area of the PFSF is 0.2116 mi^2, calculated for large commercial airliners, using the same method as was used to calculate the effective area of the PFSF for an F-16 above. Id. at 62-65. J-56 is eight nautical miles wide; V-257 is 12 nautical miles wide. Id. at 62, 66. The total probability that an aircraft flying on J-56 or V-257 would crash and impact the PFSF is therefore 3.1 E-8 per year. Id. at 65-66.

52. Takeoff and landing operations at Salt Lake City airport, which is approximately 50 miles from the PFSF, would pose no hazard to the facility. First, takeoff and landing hazards at a commercial airport generally extend out to no more than 10 miles from the end of the runway in question. See Aircraft Report at 56-60 (similar analysis for Michael Army Airfield). Second, using the method of NUREG-0800 to determine the magnitude of takeoff and landing hazards on the basis of distance from the airport and the annual number of operations there, we have shown that the risk to the PFSF is negligible. The risk posed by takeoffs and landings at an airport is insignificant and need not be considered if the number of takeoffs and landings per year is less than $1{,}000 \times D^2$, where D is the distance from the airport to the facility in question in miles.

NUREG-0800 § 3.5.1.6. In 1998, there were 365,000 takeoffs and landings at Salt Lake City airport.[7] To pose a significant hazard to the PFSF, there would have to be 2,500,000 takeoffs and landings at Salt Lake City (1,000 x 50^2). Therefore, the hazard to the PFSF posed by takeoffs and landings at Salt Lake City is insignificant. Furthermore, the FAA anticipates that the annual number of takeoffs and landings at Salt Lake City will increase by 53.1 percent, to 558,500, from fiscal year 1999 to fiscal year 2013.[8] If that is extrapolated for another 14 years, to FY2027, beyond the 20-year license term of the PFSF, the number of takeoffs and landings at Salt Lake City would be 855,000, still far less than 2,500,000. Thus, the hazard to the PFSF would remain insignificant.

G. General Aviation

53. The general aviation traffic over Skull Valley is negligible and thus general aviation would not pose a significant hazard to the PFSF. Aircraft Report at 67-73. There are no civilian airports within 25 miles of the PFSF. Id. at 70. The PFSF is located in a sparsely populated area, inside a military operating area (MOA) in which IFR flight by civilian aircraft is restricted while the MOA is being used by the Air Force (and which is avoided by general aviation pilots because of the military operations being conducted within the MOA). Id. at 67. Thus, the general aviation traffic over Skull Valley is negligible; in fact F-16 pilots who have flown from Hill AFB through Skull Valley, including Col. Fly, indicate never having seen general aviation traffic there. Id. at 67-68. Indeed, State of Utah witness Lt. Col. Hugh Horstman, who also flew F-16s over Skull Valley agreed that the general aviation traffic there was "minimal." Horstman Dep. at 220-21.[9] Therefore, it is highly unlikely that a general aviation aircraft would crash into the PFSF.

54. Nevertheless, we calculated a highly conservative upper bound on the crash impact probability for general aviation aircraft using National Transportation Safety

---

[7] Federal Aviation Administration, FAA Administrator's Handbook (Mar. 1999) at 12.

[8] Federal Aviation Administration, 1999 Aviation Capacity Enhancement Plan (2000) at A-8.

[9] Deposition of Lt. Col. Hugh Horstman (Dec. 11, 2000) ("Horstman Dep.").

Board (NTSB) crash data and the population of general aviation aircraft in the state of Utah. See Aircraft Report at 69-73. The crash impact probability is equal to C_a x A, where C_a is the crash rate per square mile and A is the effective area of the PFSF. Id. at 70a-71. In 1995, the 182,600 general aviation aircraft in the United States suffered 412 fatal accidents. Id. at 69-70. There are 1,218 general aviation aircraft in the state of Utah, which covers an area of 84,094 mi^2. Id. at 69. FAA crash data indicate, however, that only 15 percent of all general aviation crashes occur during the cruise mode of flight, which, because there are no airports nearby, is the mode in which general aviation aircraft would be flying near the PFSF. Id. at 70. Furthermore, business jets experience 7.85 percent of all general aviation fatal crashes and they can be excluded from this calculation, in that they fly mostly on federal airways. Id. The effective area of the PFSF with respect to general aviation aircraft crashes is 0.1173 mi^2 (assuming a fully loaded facility with 4,000 casks). Id. at 68-69. Accordingly, the average annual crash impact probability for general aviation aircraft is 5.25 E-7. Id. at 71.

55. Despite the calculated impact probability, however, the crash impact hazard to the PFSF from general aviation is, as a practical matter, zero because the spent fuel storage casks would be able to withstand the crash impact of the general aviation aircraft that might be found in Skull Valley. First, fifty-five percent of all general aviation aircraft are single-engine piston types weighing less than 3,500 lbs. Id. at 71. Such aircraft typically fly at speeds under 130 knots (150 mph). During a power off glide during a forced landing, which would be the most likely crash scenario at the PFSF, the airspeed is normally well below 100 knots (114 mph). See id. at 71a-72. Therefore, the impact of such aircraft at the PFSF would be bounded by the design basis tornado missile impact for the PFSF, an automobile weighing 1800 kg (3,968 lbs.) moving at a speed of 126 mph. PFSF SAR at 8.2-17. Thus, the impact of such light general aviation aircraft would not cause a radioactive release from a storage cask. Therefore, the calculated general aviation crash impact hazard to the PFSF can be reduced by 55 percent to 2.36 E-7. Id. at 72. As stated above, however, even this probability is highly conservative given PFS's

use of a state-wide average crash rate when the level of general aviation traffic in Skull Valley is negligible.

56. Second, a more detailed assessment of the ability of a crashing general aviation aircraft to penetrate the storage casks that would be used at the PFSF shows that such aircraft would not penetrate the casks and thus would not cause a release of radioactive material from the PFSF. See Declaration of Jeffrey R. Johns (Dec. 27, 2000). In that calculation, PFS shows that a crash of a general aviation aircraft with a weight of 12,500 lbs. or less (which would be those aircraft other than jets, which as noted above, would fly on federal airways rather than through the Sevier B MOA and Skull Valley) would not penetrate a storage cask. The calculation is based on the penetration capability of the aircraft engine with the greatest kinetic energy at impact. The calculation conservatively assumes, moreover, that an engine weighing 800 lbs. (the heaviest engine) could have a diameter as small as 12 inches. In fact, based on discussions with the General Aviation Manufacturers Association, a general aviation aircraft engine weighing 800 lbs. would have a rough diameter of approximately 35 inches. Thus, the penetration calculation is very conservative. Because the calculation shows that a crashing general aviation aircraft would not penetrate a storage cask at the PFSF (in addition to the traffic level being negligible), the hazard to the PFSF from general aviation aircraft accidents may be taken to be zero.[10]

H. Cumulative Hazard to the PFSF from Aircraft Accidents

57. Summing the aircraft impact probabilities from the potential aviation accidents assessed above, including potential impacts of jettisoned ordnance, the cumulative hazard to the PFSF is 6.25 E-7/year, which is below the applicable risk standard. Therefore, potential aircraft accidents do not pose an unacceptable hazard to the PFSF.

58. The results of our assessment are tabulated below.

[10] This calculation was performed after the publication of the Aircraft Report and this was not included in it.

Calculated Aircraft Crash Impact Probabilities	
Aircraft	**Annual Probability**
Skull Valley F-16s	3.11×10^{-7}
UTTR Aircraft	1.11×10^{-7}
Aircraft Using the Moser Recovery	2.00×10^{-8}
Aircraft on Airway IR-420	3.0×10^{-9}
Aircraft on Airway J-56	1.9×10^{-8}
Aircraft on Airway V-257	1.2×10^{-8}
General Aviation Aircraft	0
Cumulative Crash Probability	4.76×10^{-7}
Jettisoned Military Ordnance	1.49×10^{-7}
Cumulative Hazard	6.25×10^{-7}

IV. RESPONSES TO CRITICISMS OF THE STATE OF UTAH

59. In recent responses to PFS discovery requests, the State of Utah asserted that PFS's assessment of the probability that an aircraft would crash and impact the PFSF was deficient in some respects.[11] Specifically, the State claimed that first, additional F-16 aircraft will be stationed at Hill AFB and hence the number of sorties flown over Skull Valley and on the UTTR will be higher than what PFS assumed. Second, PFS assertedly used a crash rate that was too low for Skull Valley and UTTR military flight operations, in that 1) the F-16 will begin to experience a higher crash rate in the future as it gets older, due to an asserted "bathtub effect" in aircraft crash rates and 2) the F-16 will be replaced by a new aircraft sometime in the next 40 years and new aircraft typically have high crash rates. Third, the State claims that PFS incorrectly assumes a random distribu-

[11] State of Utah's Supplemental Response to Applicant's First Set of Discovery Requests for Contention Utah K (Dec. 5, 2000); see also Memorandum from Matt Lamb and Marvin Resnikoff to Hugh Horstman (Dec. 5, 2000) ("Lamb/Resnikoff Memo"), attached as Exhibit 9.

tion of flights through Skull Valley, in that if the PFSF is built, F-16 pilots will aim at the facility in order to calibrate their instruments before entering the restricted areas on the UTTR. Fourth, the State asserts that PFS overestimates a pilot's ability to avoid the PFSF in the event of a mishap leaving the pilot in control of the aircraft, in that 1) PFS does not account for variations in pilot experience and 2) bad weather may obscure the PFSF from the view of the pilot and hence impede his ability to guide his aircraft away from the site before ejecting. PFS responds to all of the State's claims here.

A. Additional F-16 Aircraft and Sorties

60. PFS has addressed the additional aircraft that will be stationed at Hill AFB above, in the section in which PFS describes its calculation of the aircraft crash hazard to the PFSF. PFS has also addressed the additional sorties that the F-16s currently stationed at Hill flew in FY99 and FY00. PFS assumed that the total sorties (adjusted to reflect FY99 and FY00 operational levels) would increase proportionally to the increase in the number of F-16s at the base. The effect of this are included in 58 above.

B. Skull Valley and UTTR Crash Rates

1. F-16 Crash Rates and the "Bathtub Effect"

61. The State of Utah asserts that a "bathtub effect" is exhibited by aircraft accident statistics that show that in the life cycle of an aircraft model (e.g., F-16), high accident rates are seen as the aircraft is introduced. Horstman Dep. at 75-77. As pilot and maintenance experience are gained and problems are fixed, the accident rate decreases for most of the life of the aircraft model, then increases again as the aircraft reaches the end of its life cycle because of mechanical fatigue and aging. This argument is allegedly buttressed by the observation that the F-16 accident rate for FY-99 increased. Purportedly, this presages increased accident rates in the future for the F-16.

62. This assertion, insofar at least as the F-16 is concerned, is without basis for the following reasons. First, the F-16 Class A mishap accident rate for FY-2000 has

actually decreased to 2.63 per 100,000 flight hours[12] compared to a rate of 5.11 per 100,000 hours for FY-99. It is also significantly (28%) below the FY-99 10 year average rate of 3.67 per 100,000 hours.[13] Therefore, taking the one-year FY-99 numbers as a trend would be seriously misleading. The best way to understand these accident statistics is to take a multi-year average. Three-year, 5-year and 10-year averages progressively dampen single year fluctuations. The shorter the average, the more variability there is and the more likely one is to mistake a short term aberration for a trend. As discussed in the Aircraft Crash Report (p. 11), a 5 or 10-year rate is most useful. Both the 5-year and 10-year averages show a level or steadily decreasing accident rate over the life of the F-16, even with the FY-99 figures. A graph of those averages is attached as Exhibit 8. Adding the FY-00 numbers would bring the averages down more.

63. Second, accident rates are decreasing for the total Air Force aircraft inventory as well as for the F-16 because of better maintenance, parts control, improved inspections, built-in tests and fault reporting, better pilot training and other improvements. Air Force commanders are focused on safety and will routinely reallocate resources to reduce and manage risk. According to the Air Force Chief of Safety, the Air Force experienced its lowest accident rate ever in FY2000.[14] The broad trend is illustrated by Figure 2 in the Aircraft Crash Report (behind p. 9), which shows that accident rates for Air Force single engine fighter aircraft have decreased greatly over the past 50 years. There is no reason to believe that the trend will not continue into the future.

64. Third, a study of aircraft accident rates on other fighter aircraft that have been phased out of the inventory within the last 20 years does not show a rise at the end of their lives. There are some anomalies in rates towards the very end of the life cycle of

---

[12] Curt Lewis, American Airlines Flight Safety, www.aasafety.com. Flight Safety Information (03NOV00-254), attached as Exhibit 6. American Airlines distributes articles in the press concerning aviation safety to the aviation industry.

[13] Air Force Safety Center F-16 statistics, as of January 10, 2000. Exhibit 7.

[14] Secretary of the Air Force, Public Affairs, News Release (Oct. 3, 2000).

some aircraft, where a single Class A mishap causes a large spike in the rate. This is because the number of flying hours has decreased drastically from the norm because of the sharply decreased number of aircraft remaining in the inventory. This causes a large rate change based on a single accident. This does not mean that aircraft are falling out of the sky everywhere. It only means that there are only a few aircraft of that model still flying. The risk to a facility on the ground is actually decreasing since the total number of aircraft flying, the number of sorties, the number of flight hours and the number of accidents are all decreasing.

65. The aircraft that have been phased out of the active inventory most recently are the F-111 (FY98); the F-106 (FY97); and the F-4. The F-4 is still flying a small number of hours (4,306 in FY99) but is essentially phased out. All of these aircraft exhibit the trends of decreasing or level accident rates relative to the mid-life rates except when flying hours are very low. The F-106 (Exhibit 10) is a good example of the effect of an accident when there are only a few aircraft flying and flying hours are low. The F-106 began phase-out in 1984 and most were gone by 1988. Rates (but not accidents) for that aircraft skyrocketed in its last years after 1990, but it was flying less than 100 hours in each of those years. In several cases for the F-106, e.g., in FY1992 and FY1995, the rolling average rates rose even when there were no accidents, because of the fewer number of hours being added to the denominator of the moving average equation to replace larger numbers from earlier years. Exhibits 9 through 11 show the number of flight hours and the 5-year and 10-year average crash rates for the F-111, the F-106, and the F-4, respectively.

66. Looking specifically at flying hour and accident statistics for the F-16A model, the first model of the F-16 introduced to the Air Force and therefore the oldest of the F-16s, it is apparent that most of them have been retired. As may be seen on the charts attached as Exhibit 12, flying hours were at a peak of about 170,000 hours per year in the FY 1984 to FY 1988 time frame, then have steadily decreased to about 20,000 hours in FY 1999. This indicates about a 90% decrease in the inventory of F-16A aircraft

as they are being phased out. Despite this, the accident rate has steadily gone down. Therefore, there is no reason to expect F-16 accident rates to increase in the future.

67. This observation is confirmed by statistics for the F-15A, which was also the first model of the F-15. It is the oldest of the F-15s and like the F-16A, is being phased out of the inventory. As shown in the charts attached as Exhibit 13, the F-15A flew in the neighborhood of 65,000 to 75,000 hours per year between 1980 and 1992, but it has now dropped to about 20,000 hours per year for the last 5 years, indicating about a 70% drop in the inventory of F-15A aircraft. Despite this, the number of destroyed aircraft has been 0 or 1 each year since 1987, and the accident rates show a commensurate decrease from the earlier mid-life years. (Again, the 5 year rate is showing a gradual increase, even in years when there were no accidents, because of the small number phenomenon explained in Para 65 above. The 10 year rate continued its general decrease or leveling off from the mid-life rates.)

68. For all of the above reasons, the 10-year average accurately represents what one should expect the rates to be in the future. Therefore, PFS does not need to change the accident rates for the F-16 used in its assessment.

2. Replacement of the F-16

69. The State of Utah also asserts that the introduction of a new fighter aircraft is always accompanied by a high accident rate as the aircraft comes into the inventory and is only decreased as the bugs are worked out of the system and the pilots learn its characteristics. State Dec. 5 Disc. at 4; Lamb/Resnikoff Memo at 2. Thus, the State claims that the new F-22 will be a greater hazard to the PFSF than the F-16 if it is assigned to Hill AFB as a replacement for the F-16 in the future.

70. Relatively higher fighter accident rates upon introduction to initial service were the case in the past, even with the F-16, which was first delivered to the active inventory in 1978. However, it should be emphasized that the actual initial accident rates have been generally declining. As demonstrated by Figure 2 in the Aircraft Crash Re-

port, behind page 9, initial accident rates (first spikes) have decreased significantly since the F-86 was introduced in 1950. Other aircraft introduced into the inventory in the last 30 years are the F-15 (FY74) and the A-10 (FY75). If plotted on the same Figure 2, the F-15 rate would be 10.14 and the A-10 rate would be 9.27, both below the initial F-16 rate. All of these aircraft were introduced over 20 years ago, with design technology which is now 25 to 30 years old. A further reduction in introduction accident rates is to be expected due to increased skill in designing aircraft with computer modeling and to large scale use of high fidelity simulator training for pilots so that they already know the characteristics of the aircraft before they fly. As well, the aircraft control systems and instrumentation have also improved markedly over the recent years with advances in electronics and computer power. (The F-117 stealth fighter was introduced into the inventory in 1982 but accident data on its early years is still classified and unavailable).

71. There is therefore no reason to expect that the newest computer designed aircraft, the F-22, would not be safer than the F-16 during its introduction and throughout its total life cycle, continuing a trend in fighter aircraft. Moreover, the F-22 is a twin-engine aircraft. As such, because engine failure is a significant cause of aircraft accidents, the F-22 accident rate will likely be even lower than what would be suggested by the use of modern technology in its design and construction, discussed above. Indeed, a comparison of F-16 (single engine) and F-15 (twin engine) accident rates shows that over the last 10 years, the F-15 rate has been only 50.3 percent of the F-16 rate. See Horstman Dep. at 85.

72. Finally, it is unclear that the F-22 would be a replacement for the F-16 or that it would be stationed at Hill AFB. The F-22 is specifically intended to be an air superiority fighter that would replace the F-15 and there are no F-15s stationed at Hill AFB. Horstman Dep. at 84. Moreover, the Air Force has not yet decided how many F-

22's to buy nor where to station them.[15] One informed source (Air Force Magazine, Journal of the Air Force Association, May 2000) states that Langley AFB, Virginia is the preferred F-22 unit location. The October 2000 issue states that the Air Force F-22 training will be accomplished at Tyndall AFB, Florida with 2 F-22 squadrons. So any argument about the F-22, or some other future aircraft (e.g., the Joint Strike Fighter) coming to Hill AFB and experiencing higher crash rates is highly speculative at this point.[16]

C. Distribution of F-16 Flights in Skull Valley

73. The State has raised an attractive nuisance argument concerning the proposed PFS facility. The State argues that F-16 pilots transiting Skull Valley will all point at the PFSF site sometime during their transit through the valley to update their sensors,[17] use it as a navigation turn point or maintain their prescribed position relative to other aircraft in their flight[18]. Because the F-16 pilots will point at the PFSF at some point in time, the State claims, the risk to the facility from a crash will increase. The State essentially asserts that if the facility is built, the predominant flight paths and activities which currently take place in Skull Valley will be fundamentally changed and therefore the PFS analysis no longer accurately reflects the potential risk proposed by military aviation.

74. The State fails to recognize key points in the PFS analysis. First, although the Air Force has indicated that the predominate route used by F-16 pilots favors the eastern portion of Skull Valley[19], the analysis assumed a random, even distribution of F-

---

[15] See, e.g., Greg Schneider and Thomas E. Ricks, Fighter Jet Faces New Scrutiny, Budget Crunch, Changing World Threaten $200 Billion Project, Wash. Post, December 28, 2000 at E1 (the Joint Strike Fighter, a potential replacement for the F-16, may be cancelled to pay for higher priority defense projects).

[16] Ibid.

[17] Resnikoff, paragraph 4. Decreased Effective Flight Area in Skull Valley.

[18] Horstman Dep. at 229-230.

[19] Aircraft Crash Report at 5.

16 flights over Skull Valley,[20] thereby effectively overstating the risk associated with current F-16 operations. This risk is certainly overstated when considering the proposed location for the PFS site, its proximity to restricted airspace to the west and to the south, and the routes of flight available to the pilots which will reasonably keep the pilots within the lateral confines of the MOA.[21] The geometry of the MOA induces a natural funneling effect on flights proceeding south through the narrow "neck" of the MOA east of Dugway Village, which makes the eastern side of Skull Valley (away from the proposed site) the preferred route of flight.

75. Pilots routinely perform a number of administrative tasks while transiting Skull Valley. These include: operations (ops) checks, where pilots will check the operating status of the airplane, fuel quantity and distribution, and oxygen system operation; G-awareness maneuvers where the pilot accelerates and then performs two 90° turns to check his ability to withstand G-forces and proper operation of the anti-G suit; and a "fence" check where the pilot positions certain cockpit switches as though he were preparing to cross into hostile territory. There is no prescribed order in which to do these different series of checks and pilots have different habit patterns regarding when and how they accomplish the checks. It is reasonable to assume that pilots will continue to do these routine tasks while transiting Skull Valley whether or not the PFS facility is built.

76. The State infers that pilots will use the proposed PFS site as the primary navigation point in Skull Valley.[22] Nevertheless, the State fails to give adequate consideration to the prominent mountain ranges on both sides of Skull Valley that provide excellent visual references for maintaining positional awareness and that obviate the need for a specific turn point while performing the other tasks pilots routinely perform during this phase of flight. In addition, there are other cultural features, such as ranches that can

[20] Id., at 6.

[21] Id., Tab A.

[22] Horstman Dep. at 121, 124, 126.

be used for turn points if desired. Many of these are located east of the proposed PFS site which will allow pilots to fly more directly toward the narrow "neck" of the MOA at the southern end of Skull Valley.

77. The State contends that the proposed PFS site will become a magnet for pilots and result in a significant redistribution of F-16 flights through Skull Valley.[23] The State's argument is based in part upon the lack of significant sensor signal returns from cultural (i.e., man-made) objects upon which to align the aircraft sensors, as well as for navigation as previously discussed. The State admits, however, that there are no requirements to update the sensors or to update them on any particular point,[24] that pilots update their sensors at different times,[25] and that even if a pilot chooses to update his sensors he may turn anywhere from 10 miles short of the navigation point on which he updates his sensors to where he is directly above the navigation point.[26]

78. We understand that the proposed site will be a prominent feature in Skull Valley and that some pilots may use it as a reference point for navigation, sensor alignment, or both. However, the State overestimates the impact of building the proposed facility and we do not agree that it will result in a significant change to the flight distribution pattern described in the original report.

79. First, as noted previously, the current practice is for F-16s to fly toward the eastern side of the MOA for airspace considerations and to practice terrain masking. The PFS site is located toward the western side of the MOA away from the narrow "neck" at the southern portion of Skull Valley. Pilots must still contend with the airspace limitations regardless of whether or not the PFS facility is built.

---

[23] Id. at 229-230.

[24] Id. at 159.

[25] Id. at 123, 160.

[26] Id. at 229-230.

80. Second, pilots will still be required to do those routine functions and checks discussed previously in 75. Skull Valley will remain a good location to complete these checks.

81. Third, there are other points more favorably aligned with the narrow "neck" of the MOA that can be used for navigation and sensor alignment if desired. The PFS access road which will connect the proposed facility with Skull Valley Road approximately two miles to the east will be an additional such point that can be used although it will lack the vertical build up of the PFS facilities.

82. Fourth, the State assumes a pilot must be pointed directly at the facility to update the sensors; this is not necessarily required. While as a practical matter most pilots will have the object fairly close to the nose of the airplane, to update using references on the pilot's Head Up Display (HUD), the point only needs to be within the HUD field of view (approximately 20° either side of the aircraft nose and not more than approximately 10° below the horizon). To update using the radar, a 15° angle minimum away from the nose of the aircraft provides a much more precise radar picture for the pilot. To align the targeting pod on the F-16, pilots are normally at medium altitude (15,000 to 17,000 ft MSL for Skull Valley, although they could be higher if airspace restrictions were not a factor), since the targeting pod is normally employed in the medium altitude environment. To align the targeting pod, the reference point should be within the HUD field of view, which would put the airplane at least 11.3 miles at 15,000 MSL (10,500 AGL with a 10° look down angle) away from the sensor point. This represents the closest distance at which the pilot would be able to align the targeting pod with the HUD.

83. Fifth, the State is in essence stipulating that the proposed PFS facility will be well known to all pilots since they will use it regularly as a primary visual reference point. This makes the conservative allowances built into the original PFS calculations regarding a pilot's ability to see and avoid the PFSF in the event of a mishap unnecessary, which decrease the original probabilities calculated. As discussed elsewhere, PFS

assumed that 5 percent of the time a pilot would fail to avoid the PFSF in the event of a mishap that left him in control of the aircraft, even though PFS's review of F-16 mishap reports over the last 10 years revealed no case where a pilot failed to avoid a site on the ground when he had the time and opportunity to see and avoid it.

84. The State seeks to find a higher risk to the PFSF site by changing the distribution of the flights within the Sevier B MOA based on the visibility of the site to the pilot without taking into account concomitant changes to the other parameters of the risk equation, namely the percentage of pilots who could now avoid crashing into the site because of their perfect situational awareness of its location and the elimination of any weather effect from site obscuration.

85. Finally, the State is using a specific observation that the site will be plainly visible and speculating that it will significantly change overall F-16 flight patterns without providing any supporting analysis that addresses the airspace limitations and other factors, discussed above, which impact and help shape the current operations and flight distribution pattern.

86. The conservative assumptions used in the original calculations adequately allow for any redistribution of F-16 flight operations should they occur as a result of building the proposed PFS facility. As noted, the State's argument is speculative in nature and not supported by empirical data or analysis.

D. Avoidance of the PFSF in the Event of a Mishap

1. Pilot Experience

87. During his December 11, 2000 deposition, State witness Lt. Col. Horstman asserted that when PFS determined that an F-16 pilot would be able to guide his aircraft away from the PFSF in 95 percent of the mishaps in which the pilot was left in control of the aircraft, PFS did not account for variations in pilot experience. Horstman Dep. at 173. Lt. Col. Horstman agreed that all pilots in such circumstances would intend to avoid the PFSF. Horstman Dep. at 172-73. He stated that the probability that a pilot

would succeed would be higher for more experienced pilots. Id. at 173. He then stated that only 60 percent of the Air Force's F-16 pilots are "experienced" in terms of the number of flying hours they have in the aircraft. Id. at 173-77. Lt. Col. Horstman then asserted his belief that PFS's assumption that pilots would be able to avoid the PFSF 95 percent of the time was too high because of the potential for inexperienced pilots to be involved in mishaps, but he did not know what the actual percentage should be. Id. at 175-77, 181, 185.

88. In assessing the Lt. Col. Horstman's assertion, it is important to note that during Lt. Col. Horstman's deposition and the December 12, 2000 deposition of Col. Fly,[27] the word "experienced" was used in two different contexts as it relates to pilots. The first context is commonly understood and is relevant to a pilot's ability to avoid the PFSF; the second context stems from an Air Force management tool used to maintain a balance between more junior and senior pilots it its fighter wings. Col. Horstman's reference to 60 percent of F-16 pilots being "experienced" is concerned with the latter, and not the former. See Horstman Dep. at 173-74.

89. One usage of the term "experienced" is the commonly understood noun "practical knowledge, skill, or practice derived from direct observation of or participation in events or in a particular activity[28]". In this context, a typical pilot who completes pilot training, initial F-16 training, and is then assigned to an operational fighter wing, would be considered "experienced" in terms of practical knowledge, skill or practice derived from direct participation in a particular activity, flying an F-16. Admittedly, a pilot who has been flying the F-16 for ten years is more experienced than one who has been flying it for two years. However, the basic purpose of pilot training, F-16 initial training and the mission ready training after arriving at the operational wing is to provide a sufficient level of experience to proficiently operate the F-16 under routine and emergency condi-

[27] Deposition of Col. Ronald Fly (Dec. 12, 2000) ("Fly Dep.").

[28] Merriam-Webster Collegiate Dictionary, electronic on-line version definition 2.a.

tions at home station and successfully conduct combat sorties when deployed for contingency operations.

90. The other usage of the term "experienced" is a management tool used by the Air Force related to specific pilot flying time. It is a quantitative definition used to distinguish those pilots with more flying hours in the F-16 ("experienced" pilots) from those with fewer hours ("inexperienced" pilots). There is no qualitative assessment of an individual pilot associated with this quantitative categorization. A typical pilot who completes pilot training, initial F-16 training and is then assigned to an operational fighter wing, is considered "experienced" only after he has 500 hours of flying time in the F-16.[29] This reclassification is automatic when the pilot completes the requisite number of hours. There is no prescribed level of performance or any specific evaluation associated with a pilot moving from the "inexperienced" into the "experienced" category. It is worth noting that many "inexperienced" pilots fully participated in the Persian Gulf War and combat operations in Bosnia and Kosovo.

91. Rather, the Air Force uses the "inexperienced" and "experienced" categories primarily as a management tool. The general guidelines are to have a 40/60 split of inexperienced/experienced pilots in an operational fighter wing. This ensures there is adequate intake of new pilots into the force structure to maintain a viable fighter force over time. The AF must ensure there are adequate accessions to provide a pool of individuals available to meet the demands for "experienced" fighter pilots to fill positions such as: undergraduate pilot training instructors, non-flying headquarters staff positions, etc., as well as those needed to fly the F-16. In addition, there is constant movement out of the AF by "experienced" pilots who either retire or elect to transition to civilian life prior to retirement.

[29] Pilots with different backgrounds who have transitioned into the F-16 after flying some other USAF aircraft do not require 500 hours in the F-16. If they have flown another fighter, they may be "experienced" with as few as 100 hours in the F-16.

92. During our review of the 126 F-16 accident reports, there was nothing to indicate, in those cases in which a pilot took actions following an engine failure or other emergency in which he was able to control the airplane, that the pilot's limited experience would have caused him to fail to turn to avoid an inhabited area. As explained above and stated in the report (Aircraft Crash Report, Tab H at 28 n.22), in all of those cases where inhabited areas were indicated as a consideration, pilots did in fact turn to avoid them. This is in accordance with the standard training provided to new pilots. Aircraft Report at 19-19a.

93. Further, there are three factors that mitigate any concerns of pilot experience raised by the State. First, those accidents that were assessed as accidents which could have happened in Skull Valley were randomly distributed across the pilot population. As stated in the original report, mechanical engine failures constituted the vast majority of these accidents. These engine failures would be independent of pilot experience. Therefore, in assessing the ten years of accident reports, there was a reasonable distribution of these events over the spectrum of pilot experience. As a result, the initial report indirectly considered pilot experience in its analysis. Second, the report used a lower bound limit of 90% for the fraction of Skull Valley type accidents that would leave the pilot in a position from which he could maintain control of the aircraft after the initiating event for the emergency, as opposed to the 97% that is supported by consideration of the data in the F-16 mishap reports (see Aircraft Crash Report, Tab H at 13-20). Use of the lower bound 90% fraction increases the calculated probability that an F-16 experiencing a mishap in Skull Valley would not be able to avoid the PFSF. Third, in determining the fraction of pilots with control of their aircraft after a mishap who would fail to avoid the PFSF, PFS used a 5% allowance factor as a conservatism even though the analysis did not indicate such a conservatism was warranted. As discussed above, the F-16 mishap data support an assumption that in 100% of the cases in which a pilot remained in control of his aircraft after a mishap he would be able to avoid a site on the ground like the PFSF (i.e., according to the data, PFS's allowance factor for the failure to avoid the PFSF could be set at zero).

94. Therefore, adequate allowance was made for pilot experience in PFS's original assessment. No change in PFS's assumption that pilots would be able to avoid the PFSF in 95 percent of the mishaps that left the pilot in control of the aircraft is warranted.

2. Weather Effects

95. The State of Utah asserts that cloud cover in Skull Valley will increase the risk of an F-16 impacting the proposed PFS site. The state claims that Skull Valley has at least 5/10 (five-tenths) cloud cover 46.3 percent of the time in a given year and further asserts that consequently 46.3 percent of the time, F-16 pilots would be unable to see and avoid the PFSF in the event of an engine failure or other emergency. Lamb/Resnikoff Memo at 1, 3-4.

96. The State of Utah incorrectly interprets its cloud data and therefore incorrectly applies the effect of cloud cover on the probability of an F-16 impacting the proposed PFS site. In a memorandum to Hugh Horstman dated December 5, 2000, Matt Lamb and Marvin Resnikoff assert that cloud cover will prevent a pilot in control of a crashing aircraft (e.g. after an engine failure) from directing the aircraft away from the Private Fuel Storage Facility (PFSF) 45% of the time. Id. The basis for their assumption was assertedly a statement by Lt. Col. Horstman that 45% of the time annually, clouds obscure 50% of the sky at elevations below 10,000 ft (note: AGL or MSL unspecified). In his deposition on December 11, 2000, Lt. Col. Horstman stated that the basis for the statement he made to Mr. Lamb and Dr. Resnikoff was the International Station Meteorological Climate Summary for Dugway Proving Ground ("Climate Summary").[30] Horstman Dep. at 131-32.

97. The Climate Summary, submitted by the State, indicates there is cloud coverage greater than 5/10 (five tenths) 46.3% of the time on an annual basis. The State

[30] The Climate Summary is available at https://www.airfield-ops.hill.af.mil/osw/climo/kdpg.htm.

further claims this data is the sum of the cumulative cloud coverage up to an altitude of 12,000' Above Ground Level (AGL). See id. This is incorrect and results from the erroneous assumption that the chart is based on data collected by the Automated Surface Observing System (ASOS) which has a maximum cloud measurement capability of 12,000' AGL. The Climate Survey provided by the State is based upon the compilation of manual weather observations indicated on the report as "HOURLY OBS FOR: 6005-7012, 7301-7606, 8401-9004"[31]. This corresponds to May 1960 - December 1970, January 1973 – June 1976 and January 1984 – April 1990, all of which predates the use of ASOS in 1992. These sky cover observations were made on the basis of total sky coverage (expressed in tenths) without respect to cloud altitude. Thus all that can be determined is that cumulative sky coverage was observed to be greater than 5/10 (five tenths) 46.3% of the time with no basis for determining the altitude of the sky cover. Two tenths of cloud coverage at 1,000' AGL would be reported the same as two tenths at 30,000'. The Climate Summary, therefore, does not provide any useful data on the altitude of the various cloud layers nor of a pilot's ability to operate under visual flight rules (VFR), see the ground, or maintain general positional awareness using outside references. To have a better appreciation of the potential impact on flight operations in Skull Valley, it is necessary to have more information concerning the actual weather[32] and how it could affect the pilots actions. Specifically, as shown below the Climate Summary does not mean that the PFSF would be invisible to F-16 pilots transiting Skull Valley 46% of the time.

98. For example, there could be a solid deck of clouds at 11,000 ft. AGL with nothing below that. The Climate Summary reports at least 5/10 coverage. However, it would be possible for the pilot to operate VFR under the cloud deck without any restric-

[31] Telephone call between Mr. Steve Vigeant, Certified Consulting Meteorologist, and Mr. Al Wallis of the National Climatic Data Center, Asheville, NC.

[32] A more detailed weather database is attached. See also Declaration of Stephen Vigeant (Dec. 28, 2000). Portions of the historic ceiling and visibility conditions are summarized in Tables 1, 2 and 3. They will be discussed below.

tions. This would include all of the Sevier B airspace and approximately 6,000 ft. above it. If the pilot elected to operate VFR over the clouds, he would not be able to see the ground or any other features. In this situation, the pilot would use his Inertial Navigation System (INS) aided by the Global Positioning System (GPS) for navigation and positional awareness. Due to the narrowing of the Sevier B MOA near the area to the east of Michael Army Air Field, it would be reasonable for pilots to select a ground track that pointed them toward the center of the "neck" where the MOA narrows. This ground track would keep pilots away from the eastern boundary of the UTTR restricted airspace that slants toward the southeast in the southern portion of Skull Valley. This ground track would also tend to keep pilots away from the proposed PFS location as well. Pilots maintain their positional awareness by monitoring their bearing and distance to their selected INS steer point and cross referencing their map.

99. In a second example, the total cloud coverage could be reported as 5/10 by the Climate Summary, with a 1/10 layer at 3,000 AGL, a 2/10 layer at 5,000 AGL, and a 2/10 layer at 7,000 AGL. The sum of these is 5/10 cloud coverage. When looking at the distribution of the coverage however, it is reasonable to assume that F-16's could fly VFR at any altitude up to 12,000' AGL, the maximum altitude for cloud coverage contained in the Climate Survey. If they choose to fly at 3,000'AGL, 5,000'AGL or 7,000'AGL, they might have to adjust portions of their route of flight depending on where the actual clouds were, but they could operate at any of those altitudes. If the pilots elected to fly above the highest layer of clouds, it is reasonable to assume that they could maintain their positional awareness with ground references such as mountain ranges, major roads, cultural features, etc. Because of the cumulative cloud coverage however, there will be specific points or features that might not be visible. The pilot would still have awareness of the general location of those points and features.

100. In a third example, the area could be 8/10 covered by low altitude clouds at 1,000 ft. AGL. This would preclude VFR operations below the weather. In addition, it would preclude direct identification of most ground features in the relatively flat plain

areas in and around Skull Valley. However, pilots could easily operate VFR over the clouds. In Skull Valley they would be able to maintain positional awareness using the portions of the Stansbury and Cedar Mountains that rise above the clouds and that portion of the ground which is still visible. In addition, their INS would assist them with navigation as well.

101. There are innumerable variations to this theme, but they can conclusively show that in many possible circumstances where there is cloud coverage a pilot flying through Skull Valley would still be able to see the PFSF and his ability to avoid the site in case of an in-flight mishap would not be compromised by the clouds.

102. A more detailed investigation of the cloud cover in Skull Valley below, shows that the original, conservative analysis adequately allows for the effects of cloud cover and that no further adjustments to the probability of an F-16 impacting the proposed PFS site are required.

Michael Army Air Field

Local Standard Time	Ceiling > 2,500' & Visibility > 3NM[1]	Ceiling > 6,000' & Visibility > 3NM	Ceiling > 10,000' & Visibility > 3NM
1600	353.6[2]	313.3	276.0
2200	354.5	324.3	290.7
0400	352.6	320.2	300.3
1000	350.3	321.4	294.0
Average	352.8	319.8	290.3

Table 1

[1] Based upon a 13 year average of data collected by the National Weather Service.

[2] Average number of days per year the observed weather was greater than ceiling and visibility stated at the top of the column.

Salt Lake City Airport

Local Standard Time	Ceiling > 2,500' & Visibility > 3NM	Ceiling > 6,000' & Visibility > 3NM	Ceiling > 10,000 & Visibility > 3NM
1700	346.5	323.0	283.0
2300	344.3	317.4	280.2
0500	339.3	310.6	271.7
1100	338.2	309.4	274.1
Average	342.1	315.1	277.3

Table 2

Hill AFB

Local Standard Time	Ceiling > 2,500' & Visibility > 3NM	Ceiling > 6,000' & Visibility > 3NM	Ceiling > 10,000 & Visibility > 3NM
1700	343.7	305.4	267.7
2300	345.0	312.0	274.0
0500	344.3	307.6	269.0
1100	339.8	298.3	266.8
Average	343.2	305.8	269.4

Table 3

103. Tables 1, 2, and 3 show a more detailed breakout of actual ceiling[33] and visibility for Michael Army Air Field, Salt Lake City Airport, and Hill AFB respectively. Although they do not give a detailed breakout of cloud coverage in 1,000' increments, they do provide 3 different ceilings that might affect the pilots ability to fly VFR in Skull Valley and maintain positional awareness using visual references. The data for Michael Army Air Field (AAF) is considered the most like that in Skull Valley due to its proxim-

[33] A ceiling is cumulative cloud coverage of 6/10 (six tenths) or greater.

ity and location. This is supported by the Salt Lake City Airport data which is similar in elevation but closer to the Rocky Mountains to the east.

104. First, as shown in Table 1, Column 2 an average of approximately 353 days a year (96.6%) Michael AAF has a ceiling greater than 2,500 ft. and visibility greater than 3 miles. This is supported by the Air Force brochure describing the UTTR attached as Exhibit 13. The brochure states that the range has weather of at least a 3,000 ft. ceiling and 3 miles visibility 96% of the time. Further, on page 5 it states that the visibility is 10 miles or greater 95% of the time. With a 3000 ft. ceiling, an F-16 pilot can easily and safely transit Skull Valley at 2000 ft. AGL, i.e., 1000 ft. below the clouds, and maintain situational and positional awareness with respect to the location of the PFS site, particularly when the visibility is 10 miles greater. Thus pilots can operate in Skull Valley at low altitude with little to no impact from the weather. Maintaining positional awareness using outside references would not be a problem under these circumstances. Thus, a pilot would be able to avoid the PFSF in the event of an in-flight mishap.

105. Second, the 6,000 ft. ceiling listed in Table 1, Column 3 (Ceiling > 6,000' & Visibility > 3 Mi) includes all the vertical airspace in the Sevier B MOA.[34] It clearly indicates that pilots could fly through Skull Valley and the entire Sevier B MOA, using visual reference to the ground, mountains and cultural features approximately 88% of the time (320 days per year). By comparing the data in Table 1, Columns 2 and 3, it can be seen that only 7% of the time (95%-88%) would there be a ceiling between 2,500' and 6,000' in Skull Valley.

106. Although cumulative cloud coverage could mask some specific points or features, the pilots would still have a general awareness of their location. In addition, Deseret Peak at 11,031 ft. MSL provides an excellent and very specific reference for F-16's transiting Skull Valley.

[34] Sevier B MOA extends up to 9,500 ft. MSL or approximately 5,300 ft. AGL.

107. Third, as indicated in Table 1 Column 3, the ceiling is higher than 10,000 ft. AGL (14,200 ft. MSL) approximately 79% of the time (290 days per year). The 10,000 ft. AGL airspace includes all the airspace in the Sevier B MOA, 5,500' above the MOA and approximately 71% of all the airspace above Skull Valley below the Positive Control Airspace (PCA[35]). Thus pilots could maintain positional awareness at least 79% of the time in 71% of the VFR airspace over Skull Valley, including all of the Sevier B MOA. As discussed above, in most of the remaining time a pilot could fly VFR by staying beneath the cloud ceiling in Sevier B MOA if clouds above 10,000' were a factor.

108. In the event that an F-16 pilot transits Skull Valley above a ceiling or cloud deck high enough to obscure the Stansbury Mountains (which would be at least 6,500 ft. AGL), situational and positional awareness with respect to the proposed PFS site can be readily maintained using navigation systems such as GPS and INS. Ground references, such as major roads and cultural features, when visible through breaks in the undercast, are also helpful in checking position.

109. For example, there could be a solid deck of clouds from 8,000' to 10,000' AGL. In this situation, the pilot flying above this deck would use his Inertial Navigation System (INS) aided by the Global Positioning System (GPS) for navigation and positional awareness. Due to the narrowing of the Sevier B MOA near the area to the east of Michael Army Air Field, it would be reasonable for pilots to select a ground track that pointed them toward the center of the "neck" where the MOA narrows. This ground track would tend to keep pilots away from the eastern boundary of the UTTR restricted airspace that slants toward the southeast in the southern portion of Skull Valley. This ground track would also tend to keep pilots away from the proposed PFSF location as well. Pilots maintain their positional awareness by monitoring their bearing and distance to their selected INS steer point and cross referencing their map

[35] The PCA starts at 18,000 ft. MSL. To operate in the PCA, pilots must have an approved instrument flight plan and follow Air Traffic Control instructions. VFR flights are not allowed in the PCA. Pilots do not normally fly in the PCA airspace en route from Hill AFB to the UTTR.

110. In the event that a major weather system with extensive cloud cover moves into the area and makes the UTTR unworkable for combat training due to cloud coverage and visibility, the 388th Fighter Wing would cancel or reduce their sorties because of the weather. They would also cancel their sorties if Hill AFB weather went below takeoff and landing minimums. In either or both cases, there would be no F-16s in Skull Valley. Such cases would include part or all of the time that Skull Valley experienced weather that would result in ceilings below 3,000 ft. and/or visibility less than 3 miles.

111. In summary, the more detailed USAF Air Weather Service data demonstrates that the weather in Skull Valley clearly supports VFR flight operations. Further, the weather data shows that when cloud coverage is a factor, pilots will normally be able to conduct their training below the clouds rather than above them. The 46.3% cloud coverage greater than 5/10 relied on by the State is clearly not an accurate representation of the amount of time a pilot will be able to maintain positional awareness using visual references. In addition, it does not account for pilots' general positional awareness using navigation systems when operating above an undercast that completely obscures the ground. Also, it does not allow for probable ground tracks pilots would select to keep them from violating restricted airspace when operating over an undercast or the fact that those ground tracks would tend to keep pilots away from the proposed PFS site. Finally, it does not account for the cancellation of flight operations in Skull Valley due to poor weather.

112. In addition to the weather analysis above, PFS conducted a detailed analysis of every F-16 Class A Flight mishap from FY 1989 through FY 1998. In its Report, PFS gives particular attention to aircraft destroyed (actual ground impact/crashes), engine failures, and ability to avoid a structure like the PFSF in the event of an engine failure or other emergency. One hundred and twenty-six Class A Flight mishaps were examined.

113. PFS re-examined all 126 F-16 Class A Flight mishaps and specifically assessed the impact and effect of weather and cloud conditions at the time of each mishap.

Focus was placed on determining if the weather and cloud conditions influenced the pilot's behavior and performance in a way that would have prevented avoiding a structure like the PFSF. PFS identified only eight mishaps where the weather and cloud conditions could have affected the actions taken by the pilot during the emergency and which might have impeded the ability to avoid a structure like the PFSF in a setting similar to Skull Valley. Notably, in only one instance did the pilot eject above an undercast, the scenario envisioned by the State that would cause a pilot to be unable to avoid the PFSF. This occurred in Europe where the pilot had been operating above an undercast at low altitude and zoomed higher after experiencing engine problems, but could not see the ground. In two other accidents in which pilots experienced engine failures above or in weather that prevented them from seeing the ground, the pilots specifically asked for vectors from ground controllers to avoid inhabited areas. In another case, the pilot descended below the clouds to clear the area before ejecting. In one other accident occurring below a low overcast, the pilot elected to reduce his zoom and stay below the clouds. This enabled him to keep sight of the ground and avoid hitting ground structures.

114. In summary, the 5/10 cloud coverage 46.3 percent of the time during the year presumed by the State neither accurately depicts the operational or meteorological environment for F-16's transiting Skull Valley nor realistically influences the potential risk to a proposed PFSF site. The reality of at least 3,000 ft. ceilings with at least 3 miles visibility 96 percent of the time does not pose a hazard regarding the ability to avoid the proposed PFS site, particularly when the visibility is 10 miles or greater 95 percent of the time. Moreover, even if a pilot were to experience a mishap while transiting Skull Valley above an undercast, actual mishap data shows that it would still be possible for the pilot to avoid a site on the ground like the PFSF. The real weather and cloud conditions, coupled with the detailed examination of ten years worth of F-16 Class A Flight mishaps indicate that neither the weather nor the clouds would have any significant effect on the risk to the PFSF.

115. Based upon the detailed data provided, the subsequent analysis, and the conservatisms built into the analysis, the PFS Aircraft Crash Impact Hazard adequately considers the impact of weather on the probability of an F-16 impacting the proposed PFS site. No adjustments to the analysis are required because of weather.

E. Miscellaneous

116. The State of Utah claims that aircraft jettisoning multiple pieces of ordnance would increase the effective area of the PFSF, in that there would be a slight delay between the release of the first piece and the release of the second. The State asserts that the distance the aircraft travels during the delay should be added to both ends of the effective area of the facility, north to south.

117. The 1/3-second delay at 471.8 miles per hour is equivalent to 231 feet. This would be added to the front of the area only in calculating effective area. On the back side, if the first weapon released hit the very back edge of the facility, it would not matter for the probability calculation that another hit 231 feet beyond the site. Since the depth of the cask storage area is 1,590 ft., the effect of the delay would be to increase the site area by 231/1590 or 14.5 percent.

F. Conservatism Remaining in PFS's Assessment

118. Even if the State's challenges to PFS's assessment had some merit, PFS's calculated hazard to the PFSF retains sufficient conservatism to render the State's claims immaterial. First, with respect to the F-16s transiting Skull Valley and flying on the Moser recovery, PFS used a crash rate that included not only destroyed aircraft, but also Class A and B mishaps in which no aircraft was destroyed. Aircraft Report at 25; id. Tab H at 4 n.8. Since in the 10 years of FY-89 to FY-98, there were 162 Class A and Class B mishaps but only 139 destroyed aircraft, the crash rate is overstated by 16.5%, which probably applies to both the Normal and Special Operations accident rates used in the analysis. In other terms, for this conservatism alone, the correct calculated Impact Probabilities in Paragraph 58 above are about 86% of those shown.

119. Second, and more significantly, PFS assumed that any crashing F-16 that impacted the site could potentially cause a release of radioactive material. In fact, those F-16s that impacted the site after a mishap that left the pilot in control of the aircraft would hit at a velocity of roughly 170 to 210 knots. Aircraft Report at 21. This would be low enough not to penetrate a spent fuel storage cask. Id. Chap. XI. PFS has determined that at least 90 percent of all mishaps that would otherwise result in an impact at the PFSF would leave the pilot in control, and in no more than 5 percent of those the pilot would fail to avoid the PFSF. Accordingly, in .90 x .05 = .045 or 4.5% of the total accidents, the plane could impact the site at these relatively low speeds. The other 10 percent of the mishaps would not leave the pilot in control and could simply result in an impact at higher speeds, depending on the location of the aircraft when the mishap took place. Thus, at least approximately 30 percent of all potential impacts (.045 / (0.45 + .10)) would hit at a velocity insufficient to penetrate a cask and hence the F-16 crash hazard to the PFSF from Skull Valley transits and the Moser recovery could be reduced by 30 percent.

120. In addition, as we discussed above, crashing aircraft on the UTTR would simply be too far away, as a practical matter, to fly to and impact the PFSF. PFS's calculation conservatively assumed that a crashing aircraft could glide 10 miles before impacting the site. If potential aircraft impact locations are considered more realistically, then, as even the State of Utah's witness agrees, the hazard from the UTTR can be taken to be zero. See ¶ 44, supra.

121. PFS's calculated hazard from jettisoned ordnance is also conservative in a number of respects. First, the calculation does not take into account the fact that over half of cask storage area at the PFSF will consist of open space where ordnance could impact and do no damage. Aircraft Report at 83. Second, the State of Utah has recently produced discovery in the form of a letter from the Air Force stating that none of the inert

munitions tested would penetrate the lid of a storage cask if they struck it.[36] Those weapons tested included the Mark 82, Mark 84 and CBU-87 which make up most of the jettisonable ordnance carried by F-16s on the UTTR. Most of these are inert. Aircraft Report at 81. The Mark 84 (2000 lb. bomb) could penetrate the outside wall of the structure, but it is unclear from the Col. Bauer letter if it would then penetrate the inner shell or fuel canister shell. Since Mark 84s make up only 13% of the jettisonable ordnance, in any event the actual risk from jettisoned ordnance is probably well below the figure of 1.49×10^{-7} given in the table in Paragraph 58, and is probably on the order of 2.0×10^{-8}.

122. Finally, all of PFS's calculations assume a fully loaded site with 4,000 spent fuel storage casks. In fact, the PFSF would contain 4,000 casks for only one year during its lifetime. If PFS considered a time-weighted average size for the cask storage area, the effective area of the site would be only 55 percent of the area of the site at full capacity. Thus, the average aircraft crash impact hazard for the PFSF is only 55 percent of the peak hazard. Aircraft Report at 25-27. Since effective area is integral to all calculations of risk, the total risk could likely be reduced by a factor of approximately 45% for an average risk value.

V. CONCLUSION REGARDING THE HAZARDS OF AIRCRAFT CRASHES AND AIR-DELIVERED WEAPONS USE

123. The calculated aircraft crash impact risk to the PFSF as a whole, assuming a fully loaded facility with 4,000 storage casks, is 4.87×10^{-7} per year. If the probability of jettisoned military ordnance impacting the PFSF is added to that total, the cumulative probability of an air crash or military ordnance impact at the PFSF is 6.25×10^{-7}. Be-

[36] Letter from Col. Lee Bauer, USAF, Deputy Associate Director for Ranges and Airspace, to Connie Nakahara, Utah Department of Environmental Quality (Dec. 28, 2000).

cause of the distance from the PFSF site at which weapons use on the UTTR takes place, the likelihood that a weapon used on the UTTR would impact the PFSF is insignificant. Therefore, the cumulative hazard to the PFSF from aircraft crashes and air-delivered ordnance is insignificant.

We declare under penalties of perjury that, to the best of our knowledge, the foregoing is true and correct.

Executed on December 30, 2000.

James L. Cole, Jr.

James L. Cole, Jr.

Wayne O. Jefferson, Jr.

Wayne O. Jefferson, Jr.

Ronald E. Fly

cause of the distance from the PFSF site at which weapons use on the UTTR takes place, the likelihood that a weapon used on the UTTR would impact the PFSF is insignificant. Therefore, the cumulative hazard to the PFSF from aircraft crashes and air-delivered ordnance is insignificant.

We declare under penalties of perjury that, to the best of our knowledge, the foregoing is true and correct.

Executed on December 30, 2000.

James L. Cole, Jr.

Wayne O. Jefferson, Jr.

Ronald E. Fly

EXHIBIT 1
Cole/Jefferson/Fly Declaration

JAMES L. COLE • 7711 GRIFFIN POND COURT • SPRINGFIELD, VIRGINIA 22153
(703) 455-6630

SENIOR MANAGER

PROFESSIONAL PROFILE: Eighteen years top level executive decision-making experience in air transportation, association management, safety program management, risk analysis, and flight crew training. Seasoned and skilled in the U.S. Government interagency process and legislative liaison with Congress. Expert in policy formulation and strategy development. Accomplished public speaker with many keynote addresses and trips to Capitol Hill.

EDUCATION: Executive Development Program, Cornell University
MBA, Auburn University
MA, Ohio State University
BS, U.S. Air Force Academy

1996-Present, Chief of Staff, National Air Traffic Controllers Association (NATCA). Mission is the improvement of air traffic safety and working conditions for air traffic controllers. Manage full time staff of twenty-five, an annual budget of $7 million, and maintain effective liaison with the U.S. Congress, the Federal Aviation Administration, the National Transportation Safety Board, and the aerospace and aviation communities.

Built effective coalitions with other associations and expanded NATCA's safety advocacy role
Prepared NATCA's input to the White House Commission on Aviation Safety and Security
Briefed members of Congress and GAO on aviation safety issues

1994-1996, President and CEO, National Aeronautic Association (NAA). Mission is the advancement and promotion of the art, sport, and science of aviation and space flight. NAA sanctions and certifies aviation and space records; awards major aviation trophies; and represents the U.S. internationally as the National Aero Club of the United States. Reorganized and reinvigorated NAA while achieving single greatest year of aggregate membership growth in over twenty years.

Doubled Corporate Memberships (added 23) and tripled Affiliate Memberships (added 33)
Doubled Individual Memberships (added 500)

1991-1994, Chief of Safety, U.S. Air Force. Directed entire U.S. Air Force Safety program with authority and accountability for accident prevention and investigations for 500,000 personnel and 9,000 aircraft in all aspects of ground and air operations. Managed all flight, ground, and weapons safety as well as nuclear surety of all USAF nuclear weapons. Achieved "Safest Year in USAF History."

Produced lowest number of aircraft mishaps and lowest aircraft mishap rate ever
Achieved lowest number of air and ground mishap fatalities ever

1990-1991, Assistant DCS Operations and Transportation, Military Airlift Command, U.S. Air Force. Directed all air operations and transportation functions for Military Airlift Command, including world-wide airlift, aeromedical evacuation, special operations and air rescue operations.

Managed training, qualification, standardization and evaluation of all aircrews
Maintained and managed world-wide positive command and control system
Worked DESERT SHIELD/DESERT STORM airlift of 482,000 troops and 513,000 tons of cargo

1989-1990, Inspector General, Military Airlift Command, U.S. Air Force. Led Inspection and Safety functions for Military Airlift Command. Set and enforced operational standards and inspection criteria for active and air reserve airlift units totalling 160,000 personnel and 1,400 aircraft.

Planned and administered all Operational Readiness and Management Effectiveness Inspections
Managed flight, ground, and weapons safety as well as nuclear weapons airlift surety
Investigated and resolved complaints and responded successfully to congressional inquiries

1986-1989, Senior Advisor for Joint Matters, Joint Staff, Joint Chiefs of Staff. Produced National Security papers and presentations for the Chairman, Joint Chiefs of Staff and the service Chiefs of Staff for their scheduled meetings three times each week and their weekly meeting with the Secretary of Defense.

Prepared Chairman for National Security Council meetings with the President
Orchestrated national policy and strategy issues in the U.S. Government Interagency Arena
Briefed Secretary of Defense, Joint Chiefs of Staff, and members of Congress many times

1985-1986, Commander, 89th Military Airlift Wing, Andrews AFB, Military Airlift Command, U.S. Air Force. Directed and operated worldwide VIP air transportation for U.S. President, Vice President, senior government officials and foreign dignitaries. Assets included three operational flying squadrons, a flying detachment overseas, a maintenance complex, an air passenger and cargo terminal, and a supply organization.

Recruited and trained 1,500 top quality flight crew and support personnel
Managed $10 million annual operating budget
Earned OUTSTANDING ratings on all operational and management inspections
Won Flight Safety Achievement Award

SPECIAL SKILLS AND ACCOMPLISHMENTS:

AVIATOR - USAF Command Pilot with 6,500 total flying hours. Flight Examiner and Instructor qualified. Designed and taught Flight Instructor Orientation Course on quality training, risk management, and optimal instructing techniques which increased student throughput and decreased costs by 10%. Certificated Flight Instructor/Commercial Pilot with instrument rating and 1,500 flying hours as flight instructor in C-141 (L-300), C-47 (DC-3), and T-41 (Cessna 172).

HISTORIAN - Served as Assistant Professor of History on U.S. Air Force Academy faculty. Taught Modern European and U.S. Military History. Certified as Western European Area Specialist. Course Chairman for Modern European History Honors Course and History of Air Power Course. Extensive experience in course development and syllabus preparation. Won "Outstanding Instructor of the Year" Award. Contributing author to Flying Combat Aircraft, published by Iowa State University Press. Published several articles and many book reviews in professional journals. Member of PHI ALPHA THETA (History Scholarship).

BOARDS - Member, Advisory Committee to Safety and Surety Assessment Center, Sandia National Laboratories. Member, Board of Trustees, Air Force Historical Foundation. Member, Board of Directors, Air Force Academy Society of Washington D.C. Member, Board of Directors, National Aeronautic Association.

SECURITY CLEARANCE - TOP SECRET (SCI with SBI).

EXHIBIT 2
Cole/Jefferson/Fly Declaration

Major General Wayne 0. Jefferson, Jr., USAF (Ret.)

Major General Jefferson is currently an Associate with Burdeshaw Associates, Ltd. (BAL).

From 1994 until the present, General Jefferson has been a consultant in management, management training, and quantitative probabilistic analysis.

From May 1992 to May 1994, General Jefferson was employed in private industry as Executive Director of LCC, Inc. and responsible for the accounting and finance, human resources and training functions of that company. He also served as the acting chief financial officer for 6 months. From May 1991 to May 1992, he was the General Manager of TSI, Inc., with total profit and loss responsibility for this rapidly growing company. Both of these companies were involved with engineering design support and deployment of the wireless elements of cellular telephone systems.

From 1989 to 1991, General Jefferson was President of Jefferson Associates, Inc., a consulting firm, and an Associate with Burdeshaw Associates, Ltd. (BAL).

General Jefferson retired from the U.S. Air Force on 11 July 1989 after more than 30 years of highly successful experience in leadership, decision-making, planning and management.

From April 1988 until completing service, General Jefferson served as the Joint Staffs Deputy Director for Defense-Wide C3 Support. In this position, he ensured the integrity, interoperablity, evolutionary capability and technical efficiency of all systems employed in the Defense Department's entire command, control and communications system.

From 1985 to 1988, he headed NATO's Communications and Information Systems Division on the International Military Staff in Brussels, directing NATO's highest level military C3 policy structure.

From 1984 to 1986, General Jefferson headed the Joint Staff's first Deputy Directorate for C3 Connectivity and Evaluation, directing the exercise and evaluation of the Defense Department's command and control systems in order to assure their operational capability under severe stress.

From 1980 to 984, General Jefferson held positions of rapidly increasing responsibility with the Strategic Air Command (SAC). In 1983-84, he was Assistant Deputy Chief of Staff for Operations, overseeing the entire scope of SAC's worldwide bomber, tanker, missile and reconnaissance operations, including training range development and flight operations. In 1982-83 he was SAC's Director of Command Control, responsible for the operation of SAC's tight command and control system, including the underground command center in Omaha and the airborne command post. In 1981, as SAC's Assistant Director of Plans and Policy, he was responsible for the analysis and development of SAC's future force requirements, the preparation of SAC's annual budget, and basing plans for new weapons systems. In 1980-81, he commanded a B-52 bomb wing with 17 B-52H bombers and 22 KC-135 tankers.

Prior experience included nuclear test and evaluation, Air Staff mission area planning, Vietnam flight operations, and faculty member at both the US Air Force Academy and the National War College in simulation, economics and management, focusing on operations research and quantitative decision making involving probabilistic methods.

Educational Background

Senior Managers in Government Program, Harvard University
M.S. in Operations Research, Stanford University
M.B.A, Auburn University
Technical University of Munich, Germany. Two years E.E. (in German)
B.S., U. S. Air Force Academy (distinguished graduate)
National War College (graduate and faculty member)

Air Command and Staff College (distinguished graduate)

Overseas experience

Belgium, Germany, Vietnam

Language capability in German, French, and Spanish

EXHIBIT 3
Cole/Jefferson/Fly Declaration

Resume of
Ronald E. Fly

RONALD E. FLY, Colonel, USAF (Retired)
901 S. Frankland Rd., Tampa, Florida 33629
(813) 254-2069

CAREER SUMMARY

Twenty-four years of demonstrated accomplishment in leadership, management and staff positions. Extensive operational experience to include leading three large organizations.

LEADERSHIP POSITIONS

Commander, 388th Fighter Wing, Led 2,200 personnel in nine squadrons with an annual budget of $66M.

- Maintained a 4% higher aircraft readiness rate at a 20% lower operating cost than two similar organizations, an annualized saving of $6,970,000.
- Executed the first "no-notice" Air Expeditionary Force, generated the tasked aircraft and 5 spares 12 hours ahead of schedule.

Commander, 8th Operations Group. In charge of 830 personnel in 3 squadrons with an annual budget of $24M.

- Exceeded every command readiness standard, fighter squadrons took first and second place in the command wide bombing competition.
- Aggressively managed aircraft engine repair flow to prevent the loss of 25 engines.

Commander, 63rd Fighter Squadron. Responsibilities for 325 personnel and an annual operations and maintenance budget of $10M.

- Turned the perennial "also ran" into the wing's premier fighter squadron. Won the Annual Top Combat Unit competition by the largest margin on record and swept every major maintenance and operational category.
- Maintained the wing's highest readiness rate using only 54% of the operations and maintenance budget.

STAFF POSITIONS

Chief, Defense and Space Operations Division, The Joint Staff. Responsible for operational cognizance over all air and missile defense matters, and space operations. Worked extensively at the inter-agency level on Intelligence and Missile Defense. Co-chaired the Quadrennial Defense Review Navigation Warfare subpanel.

Action Officer, International Affairs Division, Headquarters USAF. One of only six officers designated by the Secretary of the Air Force with the authority to release sensitive classified and unclassified information and technologies to foreign governments and international organizations.

OPERATIONS

Seventeen years experience in all phases of aviation to include, flight operations, maintenance, logistics, quality assurance, training and scheduling.

STRATEGIC PLANNING

Co-chaired the operations panel for the 1995-96 Advanced Battlespace Information Study commissioned by the Undersecretary of Defense Deputy for Research and Engineering and the Joint Chiefs of Staff. The Department of Defense accepted the report recommendations and redirected command and control research funds to those programs which supported the study's technology roadmap. This study, published in 1996, served as a cornerstone for the Joint Chiefs of Staffs 15 year strategic plan, *Joint Vision 2010.*

Instituted an infrastructure planning process addressing the unit's 77 buildings and 1.3 million square feet of floor space. Procured $80,000 from regional headquarters for a long-term engineering development plan.

OPERATIONAL ANALYSIS

Used unit cost and repair data to isolate a low-cost, high failure rate item in the F-16 wheel brake system. Formed and directed a team of technical experts to investigate the problem and develop corrective actions. The locally developed procedures were adopted Air Force wide in 1995.

Developed a unit based metric for tracking aircraft engine transportation to and from the Pacific regional repair facility. This metric was adopted throughout the Pacific Air Forces in 1995 and led to an asset reallocation reducing the transportation time 375%.

EDUCATION

National Security Manager's Course, Syracuse University, 1996
(2 month executive education)
Master of Science (Management), Troy State University 1985
Bachelor of Science (Economics), US Air Force Academy, 1974

PROFESSIONAL MILITARY EDUCATION

NATO Defense College, Rome, Italy, 1994
Air War College, 1988
Air Command and Staff College, 1985

RONALD E. FLY, Colonel, USAF (Retired)
Addendum

EDUCATION & TRAINING

Member, Board of Directors, Air Combat Command's Professional Military Education. Set the education and training policy and guide lines for approximately 90,000 USAF personnel.

Eight years experience as a formal course instructor.

- Wrote course objectives, study guides, teaching manuals, tests and other academic courseware.
- Designed syllabi to include integrated academic and advanced practical training flow.
- Academic instructor, taught all phases of aerial combat, air-to-air munitions, radar, electronic countermeasures, and aerospace physiology.
- Multiple awards as the Top Academic Instructor and the Best Instructor Pilot.

INTERNATIONAL AFFAIRS

Over four years experience in the HQ USAF International Affairs Division Office of the Vice Chief of Staff.

- 2½ years on the Middle East Africa desk, 2 years as the NATO and multinational desk officer
- Daily interaction with foreign attaches concerning access to USAF information and visits to USAF installations
- Technology Transfer . . . served as the gatekeepers for technology
    - Chairman, F-16 Multinational Technical Coordinating Group (US and the four NATO F-16 co-production partners). Responsible for resolving all technology transfer issues within the group.
    - Recognized expert in weapons systems, fighter aircraft, radars, and electronic countermeasures
    - Authored the USAF LANTIRN release policy, approved by CSAF

- IIQ USAF lead on the UK and French E-3 AWACS sale, adroitly handled several key issues concerning software and technical drawings.

SPACE OPERATIONS

Planned and led the ICS sponsored Tactical Exploitation of National Capabilities (TENCAP) Special Project 97 exercise. Focused on providing national capability to support theater ballistic missile defense initiatives.

Defense Support Program. The JCS lead for the current shared early warning program. Met the aggressive schedule directed by the President to provide Israel with an early warning capability, established the baseline architecture for the growing SEW initiative.

Routinely Co-chaired the NIMA Customer Advisory Board involving over 12 different agencies. Helped ensure a smooth transition as NIMA was formed by merging other agencies.

NATIONAL MISSILE DEFENSE

Designed and developed the exercise evaluation program to test NMD weapons engagement scenarios and weapons release authority levels.

PLANNING

Planned and procured funding for $7M major runway infrastructure repair project at Kunsan AB, Korea. The project, involving moving over 600 personnel and $1B dollars worth of assets to two other operating locations, was successfully executed providing much needed infrastructure repair and enhancement.

CONTINGENCY EXECUTION

Led the Hurricane Andrew evacuation, involving 75 airplanes and over 200 personnel, from MacDill AFB, FL to Dobbins AFB, GA. The short notice evacuation was smoothly executed with minimum problems.

OPERATIONAL TEST AND EVALUATION

Commander of the Utah Test and Training Range., the largest overland range in the free world and the only overland range authorized for test of cruise missiles and other large safety footprint weapons.

- Directed the use and implementation of test range assets for calibration of airborne laser targeting systems. Leveraged the use of test equipment to improve operational capability.

- Implemented new procedures to increase range safety and minimize the possibility of damage to non-test facilities located on the range.

LOGISTICAL SUPPORT

Identified problems with a high cost, high failure rate component of the F-I 6 radar.

- Developed local operational and repair procedures to increase the mean time between failure rate and increase the radar reliability.
- Directed technicians to work with the regional repair facility and identify a long term improvement. A redesign of the component involving a new memory chip was developed and an 18 month replacement plan initiated.

EXHIBIT 4
Cole/Jefferson/Fly Declaration

Private Fuel Storage
Aircraft Crash Impact Hazard at the Private
Fuel Storage Facility, Revision 4
August 10, 2000

Provided Separately

EXHIBIT 5
Cole/Jefferson/Fly Declaration

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

EXHIBIT 5 COLE/JEFFERSON/FLY DECLARATION

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: NONE

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.