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March 30, 2001

REQUEST FOR ADDITIONAL INFORMATION
ON AIRCRAFT HAZARDS – PARTIAL RESPONSE
DOCKET NO. 72-22 / TAC NO. L22462
PRIVATE FUEL STORAGE FACILITY
PRIVATE FUEL STORAGE L.L.C.

Reference 1: NRC Letter, Delligatti to Parkyn, Request for Additional Information, dated March 9, 2001.
Reference 2: February 27, 2001 teleconference between PFS and the NRC.
Reference 3: PFS Letter, Donnell to Delligatti, Request for Additional Information, dated March 20, 2001.

Attached please find the partial response by Private Fuel Storage (PFS) to the Request for Additional Information on Aircraft Hazards from the Nuclear Regulatory Commission (NRC) dated March 9, 2001 (Reference 1). As identified to the NRC in Reference 3, Freedom of Information Act (FOIA) requests have been submitted to the U.S. Air Force to resolve, if possible, the balance of the information request. The questions that remain open are identified in the Attachment.

If you have any questions regarding this response, please contact me at 303-741-7009.

Sincerely

John L. Donnell

John L. Donnell
Project Director
Private Fuel Storage L.L.C.

NMSS01 Public

Copy to:
- Mark Delligatti
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RESPONSE TO MARCH 9, 2001 NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING AIRCRAFT AND CRUISE MISSILE HAZARDS AT THE PRIVATE FUEL STORAGE FACILITY

AIRCRAFT DEPLOYMENT AND SORTIES

1. Provide the following items which are related to the effect on the aircraft crash probability at the proposed PFSF from the additional F-16 aircraft and resulting sorties at Hill Air Force Base:

> (a) Clarify the total number of F-16 aircrafts that would be stationed at Hill Air Force Base as a result of the addition of 12 new F-16 aircraft.
>
> Exhibit 9a the Declaration of James L. Cole, Jr., Wayne O. Jefferson, Jr. and Ronald E. Fly before the Atomic Safety and Licensing Board, December 30, 2000 (Cole et al.), indicates the total number could be 84 rather than 81 which is referenced in your letter dated January 19, 2001.

Response

The total number of aircraft to be stationed at Hill AFB after the addition of the 12 new aircraft, and when all are at home station (none deployed) is 81. At the time the Report was written (August 2000), there were 69 F-16s assigned to Hill AFB, 54 of which were assigned to the 388th Fighter Wing and 15 assigned to the 419th Reserve Fighter Wing. If an additional 12 are assigned to the 388th FW (no additional F-16s are foreseen to be added to the 419th RFW), then the total will rise from 69 to 81.

Exhibit 9a is a memorandum from State of Utah witnesses Matt Lamb and Marvin Resnikoff to Hugh Horstman, dated December 5, 2000. PFS has since confirmed its information on the number of F-16s assigned at Hill AFB from Hill; PFS is unaware of why Mr. Lamb and Dr. Resnikoff stated that there were a different number of F-16s at the base.

> (b) Discuss whether the number of F-16 aircraft deployed at Hill Air Force Base is directly proportional to the number of sorties flown through Skull Valley and the UTTR. For example, discuss whether an increase in the number of deployed F-16 aircraft could actually result in a less-than or more-than proportional increase in the number of sorties flown each year.

Response

Changes in the number of F-16 aircraft at Hill AFB will result in a proportional change in the approximate number of sorties flown through Skull Valley and on the UTTR. Since the squadrons at Hill AFB all have similar training requirements, they tend to fly similar schedules in terms of airspace usage and mission types (simulated air-to-air combat, medium altitude surface attack, low altitude navigation and bombing, etc.). As a result, with the addition of F-16 aircraft to Hill AFB, it is reasonable to assume that there will be an approximately proportional increase in flights through Skull Valley and the other portions of the UTTR. Similarly, with the departure of aircraft from Hill AFB, it is reasonable to assume that there will be an approximately proportional decrease in flights through Skull Valley and the UTTR. For example, if a fighter squadron were to deploy to Southwest Asia with its entire complement of airplanes, it is reasonable to assume that there would be a proportional decrease in the overall flight activity (sorties, Skull Valley transits, UTTR missions) from Hill AFB for the duration of the deployment.

(c) Discuss the relationship (e.g. proportional increase) of the deployment of additional aircraft at Hill Air Force Base to the assignment of additional flight crews and maintenance personnel to operate and maintain the additional aircraft. Specify whether the assignment of additional flight crews and maintenance personnel is a determining factor in the number of sorties flown.

Response

As the number of assigned aircraft is increased, there will be an approximately proportional increase in pilots and maintenance personnel. Squadron pilot and maintenance manning is based upon the number of assigned aircraft (the Air Force term is Primary Aircraft Authorized (PAA)). As the PAA for the 388th Fighter Wing is increased, additional pilots and maintenance personnel will be will be assigned to the Wing.

In addition to the increase in pilots and maintenance personnel, additional funding, flying hours and resources will be provided when the number of assigned aircraft is increased. The operating budget is funded on a dollars per flying hour basis. The flying hour program (FHP) is directly proportional to the number of PAA at the base. The total flying hour budget is based upon a per dollar rate times the total Flying Hour Program. As the number of aircraft increases, the support funding will increase proportionally.

Therefore, as the number of F-16 aircraft assigned PAA to the 388th FW increases, the number of pilots, maintenance personnel, flying hours and the amount of support funding will increase proportionally. These are determining factors in the number of sorties flown and a change in them will result in a directly proportional change in sorties flown.

Occasionally, the Air Force will assign one or more extra aircraft to a wing which are not counted as PAA. These are known as backup aircraft inventory (BAI) aircraft. When these are assigned to a wing, no additional pilots, maintenance personnel, support funding or flying hours are given to the wing.

(d) Provide an estimate of the number of flights through Skull Valley and to the UTTR South over the proposed life of the facility based on the new data for additional F-16 deployment.

Response

An estimate of the number of flights through Skull Valley and to the UTTR South must be based on the assumption that the number of flights (sorties) through Skull Valley and into the

UTTR South is proportional to the number of F-16s at Hill AFB. (See response to question 1b, above). The number of F-16s at Hill AFB will not be more than the number assigned to the Fighter Wings there (with the exception of possible BAI aircraft as discussed in 1(c) above, which do not affect numbers of sorties), and will be less as some of those aircraft are deployed to other locations for various military reasons. The best information at this time is that the maximum number of F-16s assigned PAA to Hill AFB will be 81 (see 1(a) above). There is no information to indicate that aircraft will be added or removed from either Fighter Wing at Hill AFB in the foreseeable future. Nor is there any information to indicate that additional wings will be stationed at Hill AFB.

Based on this, PFS estimates that the number of sorties through Skull Valley and to the UTTR South will be not more than that seen in FY 2000, as adjusted for the newly assigned aircraft, and probably less as a result of probable aircraft deployments for extended periods of time to other locations. Hence, PFS has projected sortie counts as an average of FY 1999 and FY2000 counts, adjusted for the newly assigned aircraft. This projection is valid for the foreseeable future. Since the proposed life of the facility is 40 years, projections for that length of time are necessarily limited.

(e) Provide data on the number of F-16 sorties flown through Skull Valley each year from FY 1998 to FY 2000 and the number of aircraft stationed at Hill AFB for the same years.

(f) Provide a breakdown of the number of flights to the UTTR South area including number of hours spent in each discreet area of restricted air space in FY 1999 and FY 2000.

(g) Discuss whether the number of hours spent in air-to-air and air-to-ground combat training on the UTTR South area increases proportionally with the total number of F-16 sorties flown through Skull Valley.

Response

Questions 1(e), (f), and (g) will be answered upon the receipt of responses to PFS Freedom of Information Act (FOIA) requests to the U.S. Air Force and U.S. Army.

2. Provide the following items which are related to the effect on the aircraft crash probability at PFSF from aircraft sorties flown in IR-420:

(a) Specify the number of flights through IR-420 in FY 2000.

(b) Identify and describe any routes other than Skull Valley and IR-420 by which aircraft enter the UTTR South area and provide the associated traffic rates in relation to the known air traffic rate for Skull Valley.

(c) Specify whether all of the aircraft going to Michael Army Air Field through IR-420 are transport aircraft.

Response

Questions 2(a), (b), and (c) will be answered upon the receipt of responses to PFS FOIA requests to the U.S. Air Force.

CALIBRATION AND TARGETING

3. Provide the following items which are related to the effect on the aircraft crash probability at the proposed PFSF from turning point maneuvers of F-16 aircraft:

(a) Define and discuss the meaning of "turning point in Skull Valley" and discuss the maneuvers associated with this term, as referenced in Cole et al.

Response

The term "turning point" is used to indicate a navigation point as part of the route of flight. The normal route of flight for transiting Skull Valley is to pick up a south, southwesterly heading while over the western portion of the Great Salt Lake and enter Skull Valley from the north. From the northern portion of the valley, pilots will turn to a southerly heading and fly toward the narrow neck of the airspace east of English Village on Dugway Proving Ground (a/k/a Dugway). If desired, pilots may select a turn point somewhere in the valley. This point is normally visually identifiable such as a road intersection, a ranch or any other recognizable feature. Pilots will occasionally select a turn point that is only an intertial navigation system (INS). See response to question 4 for an explanation of the INS point that does not have any visually distinctive characteristics. As an example, a pilot may select a turn point in the narrow neck portion of the Sevier B MOA, southeast of English Village, to have an INS point that could be used to ensure the flight stayed within the narrow corridor. Having an INS turn point is especially useful when navigating unfamiliar terrain as it allows the pilot to track his progress with the onboard navigation systems.

The great majority of the time, the weather[1] permits pilots to navigate through Skull Valley using only visual references, without requiring a turning point in Skull Valley. The Stansbury and Cedar Mountains provide excellent visual references that enable pilots to maintain their positional awareness and obviate the need for a turning point in Skull Valley. On the other hand, pilots always have the option of using a turn point in Skull Valley even when the weather is clear.

When approaching a turn point, the pilot will typically do the following things: confirm he is on course and on-time, monitor the position of his flight members, plan and clear his flight path for the turn to the next heading, and select the next INS steer point.

(b) Verify whether the Air Force will use the proposed PFSF as a turning point in Skull Valley and if this would result in flights directly over the proposed PFSF.

[1] Refer to the responses to question 9 for a more detailed discussion on the weather conditions in Skull Valley and their impact on flight operations.

Response

As stated in the Report[2], the primary route of flight in Skull Valley is down the eastern portion of the valley toward the Stansbury Mountains. An overview of the airspace and geography of the area is helpful in understanding why this is the predominant route of flight.

The MOA is significantly wider at the northern portion of Skull Valley than at the southern end, narrowing from approximately 17 statue miles to 7 statute miles[3]. As a result of this narrowing, the operational utility of the airspace west of Skull Valley Road, located in the center of the valley and under which the PFSF site is located, decreases significantly toward the southern portion of Skull Valley, up to the point where Skull Valley Road is itself underneath the restricted airspace of R-6402. Since the airspace "funnels" the flights eastward as they approach the southern portion of valley, flights tend to favor the eastern portion of the airspace as they transit from north to south.

Pilots may or may not elect to have a turn point in Skull Valley. If they elect to have a turn point in Skull Valley, they may or may not select the proposed Private Fuel Storage Facility as that turn point. While the proposed facility would have the advantage of being larger than any other man-made feature in the valley, the close proximity of restricted airspace to the west and the south (within 2 miles of the site) is a disadvantage that does not affect other potential turn points. In addition, if the proposed PFS site was one of the planned turn points, it would require a second turn point approximately 10 miles southeast of the PFSF (at which point the pilot would turn back to a more southerly heading) to stay within the MOA.

Further, pilots tend to perform a variety of checks and routine maneuvers (e.g. G awareness maneuver) in Skull Valley that are intended to prepare for the tactical training portion of the mission. The Stansbury and Cedar mountains are more than adequate references for pilots to maintain their positional awareness during these maneuvers and checks. Thus a turn point in the valley is not required.

Pilots normally fly toward their selected turn points. Therefore, it would be expected that if pilots selected the PFSF as a turning point, they would fly toward and perhaps over the PFSF site. Due to the proximity of the restricted airspace however, pilots may elect to turn prior to reaching the facility.

While it is not unreasonable to assume that some of the pilots may select the proposed PFSF as a turn point; given the shape of the MOA and the proximity of the restricted airspace, there is no compelling reason to assume that building the PFSF will cause a significant change in the historic flight patterns. Use of the PFSF as a turn point adds little for the types of flying normally done in Skull Valley.

[2] Aircraft Crash Impact Hazard at the Private Fuel Storage Facility, August 10, 2000 (Revision 4), page 5.

[3] Refer to Question 8 for a more detailed description of the airspace over Skull Valley.

4. Provide the following items which are related to the effect on the aircraft crash probability at the proposed PFSF from navigation sensor calibrations on F-16 aircraft:

Response

Before addressing the specific items in question 4, the Inertial Navigation System (INS) is the basis for the onboard F-16 navigation capability. The INS is aligned to the aircraft's current position after engine start. After being aligned, the INS continuously updates the aircraft position and velocity based upon accelerations sensed by its internal gyroscopes. In addition, to knowing the aircraft's current position, the INS data is used to compute the bearing and distance to the selected steer points[4].

The Block 40 F-16 flown by the 388FW is capable of receiving and using the Global Positioning System (GPS) navigation signal. The GPS can be used to automatically update the INS's current or "present" position in the event of an INS "drift error"[5]. This is the normal mode of operation for the 388FW[6].

(a) Define and discuss the meanings of "sensor alignment," "reference point for navigation," and navigational system steer points," as referenced in Cole et al.

Response

The term sensor alignment is used to refer to the pilot monitoring and ensuring that the INS present position is accurate. Pilots typically do this visually[7] by using the information depicted on the Head Up Display (HUD)[8] to cross check the INS system. However, pilots may do this using the radar if the selected steer point is capable of being detected by the radar[9].

A "reference point for navigation" can be any identifiable point that can assist in navigation. Road intersections, water towers, mountain ranges and peaks, bodies of water,

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[4] The route of flight for each mission is programmed into the INS as a series of steer points (destinations). The pilot normally has the next steer point on the route of flight selected, although, he may select any steer point. Steer points are also known as turning points or navigation points.

[5] An INS normally has a small drift error measurable in the feet per second range. In essence, it is common for an INS to sense a small velocity when the aircraft is in fact stationary. Over time the cumulative effect of this drift translates into an error in the current or present position. The present position error can be corrected by updating the INS. However, INS updates only correct the position error, they do not correct the inherent drift problem.

[6] The 419FW has the Block 30 aircraft which is not GPS capable. If the INS present position has drifted, the pilot must update the INS manually. This can be done either visually or using the radar.

[7] In order for the selected steer point to be displayed in the HUD, it must be within 15° of the nose of the aircraft (the HUD field of view is 30° wide) and no lower than approximately –11° in elevation, the point at which it starts to be blanked by the aircraft radome. As a practical matter, it is normally within a few degrees laterally of the nose and approximately –5° to –10° in elevation when this is accomplished.

[8] A "TD Box" is displayed on the F-16 Head Up Display (HUD) where the system calculates the INS steer point to be located. If the TD box is not over the actual steer point (e.g. building, road intersection, etc.) then either the target coordinates are incorrect, there is an INS present position error, or a combination of the two.

[9] Refer to question 9(c) for a more detailed discussion of the F-16 radar.

buildings or cities, etc. are all examples of "reference points for navigation". These points may or may not be programmed as one of the INS steer points but provide the pilot with visual cues that enable him to maintain his positional awareness.

"Navigation system steer points" are the steer point latitude and longitude coordinates programmed into the INS. The intended route of flight is normally programmed as a sequential series of points. Additional points of interest, such as potential divert or emergency airfields, are generally programmed as well.

(b) Discuss whether it is a standard practice for pilots to calibrate aircraft sensors during flight or during pre-flight on the ground.

Response

The INS and the LANTIRN (Low Altitude Navigation and Targeting Infrared Night) system are the primary sensors of interest concerning calibration on the ground and in-flight. INS calibration was discussed in the introduction to the response to question 4 and in the response to question 4(a).

The LANTIRN system has two components, the navigation pod and the targeting pod. The navigation pod is used at night to assist with navigation. The navigation pod is a relatively wide field of view (28^{o}) imaging infrared (IIR) sensor that projects the IR image on the HUD, thereby enabling the pilot to visualize the terrain ahead. Since the navigation pod is mounted below and to the side of the aircraft fuselage, a small parallax error may cause the IR image to be slightly offset in the HUD (e.g., the IR image of a tower directly in front of the aircraft may not be exactly overlaid on the actual water tower). The pilot can easily correct this with a one-time adjustment either on the ground or in the air.

The targeting pod is used for laser guided bombs[10]. The targeting pod is normally positioned (boresighted) to look at the selected INS steer point; the pilot does not have any capability to adjust this automatic positioning function[11]. The pilot can, however, adjust the targeting pod focus. The targeting pod initial focus setting is in the middle of the adjustable range when the pod is first turned on. This initial focus setting is normally adequate for successful operation of the system. Pilots can manually adjust the focus if desired. If the pilot elects to focus the targeting pod, he will normally attempt to do this at approximately 6-8 miles[12]

[10] The targeting pod is normally used at medium altitude (i.e., at 15,000 to 25,000 ft. AGL). The USAF has discontinued training their pilots for full low altitude LANTIRN employment (i.e., night low level at 500' AGL, automatic terrain following radar, loft bombing using the targeting pod). The targeting pod is of little value in the low altitude bombing events that all F-16 pilots are qualified to perform. These missions can be successfully completed if the targeting pod is never used.

[11] The pilot can take control of the targeting pod sensor and position it as desired. He can also command it to track an object. Neither of these affect the boresight however.

[12] The aircraft does not need to be pointed at the point of interest to focus the pod, it must however be within the gimble limits of the targeting pod which can swivel to see most of the sphere below the aircraft. As a practical matter the pilot is normally pointed toward the INS steer point and it is within the HUD field of view. If a flight of two aircraft was flying a line abreast formation with 2nm separation between aircraft, the flight was 8nm from the

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from the selected point of interest. This is the range at which he would be finalizing his target tracking solution if this was a bombing pass. Focusing the targeting pod is normally a once per mission event, and may be accomplished on the ground or in the air, if required.

As discussed in the answer to question 4(e), a pilot might use the PFSF to focus his targeting pod, but there would be no requirement that he do so.

(c) Discuss whether pilots currently calibrate aircraft navigational sensors and the targeting pod during flight.

Response

As discussed in 4(a), the INS is normally automatically updated by the GPS system both on the ground and in the air. The 419FW pilots must manually update their INS if there is a present position error. In either case, pilots will routinely monitor the INS during flight to ensure there are no malfunctions.

As discussed in response to question 4(b), the targeting pod does not necessarily require focusing. On those occasions when it does, the pod may be focused on the ground or in the air. As a practical matter, pilots normally check and adjust the targeting pod focus on the ground prior to takeoff.

(d) Describe the pilot's current actions while flying through Skull Valley, including activities associated with the calibration of navigational instruments.

Response

As noted in the Report[13] Skull Valley is used primarily as a transition corridor to the southern UTTR. Many of the pilot actions are geared toward completing checks and maneuvers in preparation for the tactical training portion of the mission, the demanding portions of which typically occur within the confines of the restricted airspace to the west of Skull Valley.

The following is a typical sequence of events for flights transiting Skull Valley. It is a representative sequence that includes the types of things normally done in Skull Valley. Flight leads have a significant degree of latitude in determining what will be done and when, as long as those things required by existing policies and regulations are accomplished. However, there tend to be generally accepted ways of doing business. Flight leads tend to accomplish administrative requirements such as fence checks, G awareness turns, etc. early in the flight to minimize impact on the tactical maneuvering portions of the mission.

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steer point, and the steer point was between the paths of the two aircraft, each aircraft would be pointed one mile to the side of the steer point, which would be approximately 7°-8° laterally off the nose.

[13] Aircraft Crash Impact Hazard at the Private Fuel Storage Facility, August 10, 2000, (Revision 4), Tab E

1. As the flight approaches Skull Valley, they will change to a discrete radio frequency as directed by Clover Control for communication between each other and with the range controllers.

2. The flight leader will direct an "ops (operations) check". Pilots will confirm normal operations of the aircraft systems (hydraulic pressures, oil pressure, engine instruments, exhaust nozzle, etc.) and proper fuel distribution and fuel transfer from the external tanks[14].

3. The flight lead will then call for a "fence check". During the fence check, the pilot will position his aircraft offensive and defensive systems switches in preparation for combat as if he were "crossing the fence" into hostile territory. During the fence check the pilot will: select (but not arm) the appropriate air-to-air and surface attack weapons, confirm or select the desired radar submodes, confirm proper radar operation, check for proper HUD and radar symbology, adjust the threat warning system audio and visual displays, select the appropriate electronic countermeasures (ECM) pod settings, select the appropriate defensive countermeasures (chaff and flare) settings.

4. If not previously accomplished, the flight lead will then direct the flight to a tactical (spread out) formation. The flight will then accelerate and accomplish a G awareness maneuver[15].

5. Typically, this series of checks can be completed prior to passing English Village if the flight lead so desires and sequences them appropriately.

6. Depending on the programmed steer points and the mission profile, the flight may or may not verify Inertial Navigation System (INS) accuracy and focus the LANTIRN targeting pod[16], if required, in Skull Valley.

See question 4(e) for a discussion of the conduct of these activities if the PFSF were built in Skull Valley.

(e) Discuss and analyze the impact on the pilot's actions, if the proposed PFSF is constructed.

The analysis should consider any potential narrowing of the effective width of the flying area as a result of the proposed PFSF.

Response

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[14] To check proper fuel distribution and external fuel tank transfer, the pilot must rotate the fuel quantity select knob to the desired position, let the reading stabilizes (typically a few seconds), and rotate it to the next position, until complete. This can be accomplished in approximately 15-20 seconds.

[15] Refer to answer 6c for a more detailed discussion of the G Awareness maneuver.

[16] Refer to answers 4b and 4c for a more detailed discussion on focusing the LANTIRN targeting pod.

As noted in the Report[17], the predominant route of flight through Skull Valley is toward the eastern side of the valley along the Stansbury Mountains. This historic pattern is in part attributable to the eastern protrusion of restricted area R-6402 which significantly narrows the width of the Sevier MOAs in the vicinity of English Village. This narrowing funnels the traffic pattern toward the southern neck of Skull Valley which is easily identifiable by the southeastern end of the Cedar Mountains. As a result, pilots tend to point at and fly toward the narrow, southern portion of Skull Valley as they enter it from the north. This historic flight pattern is a function of the airspace shape, which is not affected by any man-made structures. Thus, the PFSF will not affect the effective width of the flying area in the valley.

The proposed PFSF location is relatively close to R-6402,[18] approximately halfway down the border between restricted airspace (R-6402) and the western Sevier B MOA boundary that slopes toward the southeast and funnels the flights toward the east. Although it is possible that some flights may elect to use the PFSF as a navigation point or to focus the LANTIRN targeting pod, there is no requirement for either[19]. In addition, the desire to verify the INS present position against a known point on the ground, or focus the targeting pod if required, would not obviate the requirement to avoid R-6402 west and south of the PFSF. Therefore, it is reasonable to assume that pilots using the site for this purpose would turn prior to reaching the site as stated by Lt. Col. Horstman[20] in his deposition.

In the event a flight leader decided to use the PFSF as an INS steer point or to align his sensors, it is reasonable to assume that every pilot in the flight would have specific knowledge and awareness of the PFSF location as they entered Skull Valley. As noted in the Report[21], due to the small area of the PFSF, only a small turn of a few degrees would be required to avoid the site in the event of an emergency.

In addition, in the event a flight decided to use the PFSF as a reference point for either navigation or to focus the targeting pod, at least 50% of aircraft in those flights that use the PFSF as such a reference would not be pointed at the site[22] (i.e. if the flight lead is pointed directly at the site, his wingman, nominally 9,000 ft. line abreast of the leader, would be pointed in the general direction of the site but over a mile to the side of the site). It is quite possible that neither aircraft would be pointed directly at the site even though both aircraft may be pointed in the general direction of the site[23].

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[17] Aircraft Crash Impact Hazard Report at the Private Fuel Storage Facility, August 10, 2000, (Revision 4), page 5.

[18] Refer to question 8 for a more detailed discussion of Skull Valley and the Sevier MOA dimensions.

[19] Refer to questions 4(b) and 4(c).

[20] Deposition of Hugh Horstman (Dec. 11, 2000) at 229-30.

[21] Report at 22-23 & n.28.

[22] Lateral separation between aircraft is nominally 9,000 ft., approximately six times wider than the PFSF. Depending on visibility and other environmental factors it may vary between 6,000 ft. and 12,000 ft. Due to the excellent visibility typically found at the UTTR, flights tend to favor the 9,000 ft.+ separation.

[23] See answer to question 4(c).

Alternatively, as noted in the answer to question 3(b), if the flight planned to use the PFSF as a navigation point, they would need a second turn point approximately 10 miles to the southeast to avoid the restricted airspace to the west and the south of the PFSF. With the prevailing excellent visibility associated with the UTTR, the flight lead may point his flight toward the narrow southern neck of Skull Valley, then individual flight members could select an INS steer point with the PFSF coordinates programmed to focus their targeting pod. From the northern portion of the MOA this would provide both flight members the opportunity to focus their targeting pods, if required, while maintaining a southerly heading and flying to the east of the proposed PFSF and avoiding the restricted airspace to the west and the south of the PFSF.

The basic airspace configuration over Skull Valley will continue to be the primary factor in determining the predominant aircraft flow. With the close proximity of the restricted airspace to the proposed PFSF, there is no compelling reason to assume that the historic aircraft flow will be fundamentally changed and shifted west to over fly the PFSF. Even those flights which elect to use the PFSF for INS alignment or to focus their targeting pods can be expected to frequently turn toward the narrow neck of the airspace prior to reaching the site.

5. Provide the following items which are related to the effect on the aircraft crash probability at the proposed PFSF from targeting actions on F-16 aircraft:

(a) Discuss whether the pilots would point and target their aircraft instruments on the proposed PFSF and the circumstances for performing such action (e.g., only for updating instruments for turning, G-awareness maneuvers).

Response

The different circumstances in which pilot would point and target their aircraft instruments on the proposed PFSF are described in the answers to questions 4, 6 and 9. During G awareness turns, if the aircraft were to point at the PFSF it would only be momentary. As stated elsewhere, there is no requirement to use the proposed PFSF for any of the described purposes, although the pilot would have the option of doing so. A pilot who elected to use the proposed PFSF for updating his instruments would still need to remain cognizant of the restricted airspace to the west and to the south of the site.

(b) Discuss the range of distance(s) from the proposed site and length of time that the pilots would initiate and continue the point and target action.

Response

If the pilot were to use the proposed PFSF site as a navigation point, it is reasonable to assume he would be pointed toward the site from a location starting in the northern portion of the valley. As noted in the answer to question 4, a maximum of 50% of those aircraft in the flights that elected to use the PFSF as a navigation point would actually be pointed at the site. If the pilots in a flight elected to focus their targeting pods on the PFSF, they would need to have the targeting pod, not necessarily the aircraft, looking at the site for approximately 10 seconds (during which time the aircraft would fly approximately 1.1 nautical miles (assuming a speed of 400 knots)).

(c) Describe the pilots subsequent actions and aircraft maneuvers after pointing and targeting the proposed PFSF.

Response

The pilot actions are described in the answers to question 4.

AIRCRAFT MANEUVERS

6. Provide the following items which are related to the effect on the aircraft crash probability at the proposed PFSF from certain aircraft maneuvers:

(a) Discuss whether regrouping after maneuvering in a simulated engagement is similar to normal flight activities and whether it is consistent with the definition given in the DOE ACRAM study.

Response

The flight regrouping after maneuvering is a normal flight activity consistent with the ACRAM study definition of Normal flight. During air-to-air training, the aggressive maneuvering, often referred to as "tactical maneuvering", which takes place toward the center of the area, ceases when one of the flight members, normally the flight lead, transmits a "Terminate" radio call. The "terminate" call is subsequently acknowledged by all the flight members. The most common reason for the "terminate" call is the desired learning objective has been achieved, although other situations, such as a stalemate, or reaching the planned fuel for returning to base, etc. are also reasons for terminating the engagement[24]. In the less likely event a more serious situation that may compromise safety of flight has developed, cessation of the aggressive (tactical) maneuvering may be initiated with a "Knock it off" call[25]. In either case, the first two actions taken by the pilots are 1) visually ensure a clear flight path and 2) cease tactical maneuvering,

After the tactical maneuvering has ceased, pilots will then reform their flight(s) and prepare for the next training event (also referred to as an "engagement"). If the next event is planned as a "within visual range" engagement, then pilots will maintain visual contact with each other while positioning themselves with respect to each other and within the area. Typically, this will include climbing up to the desired altitude; checking fuel and engine operation, etc., and briefly discussing the previous engagement and/or the upcoming engagement. During this phase of flight, visual contact is maintained by the pilots and separation of aircraft tends to be in the 1 mile range[26]. Maneuvering is generally minimized and designed to keep the flight toward the center of the area.

In the event the next engagement is to start beyond visual range, typically in excess of 25nm separation, the flights will proceed toward their designated start (rendezvous) points. En route to the points, pilots will perform the same checks and tasks discussed in the previous paragraph. Once at their respective start points, the flights will establish benign maneuvering

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[24] Air Force Instruction 11-214, 28 February 1997, *Aircrew, Weapons Director, and Terminal Attack Controller Procedures for Air Operations,* paragraphs 2.7.3.4 and 2.7.3.5

[25] *Ibid,* paragraphs 2.7.3.2 and 2.7.3.3

[26] This is at the flight lead's discretion; a mile separation enables the pilots to relax while climbing to altitude, perform the required checks, etc. without having to fully concentrate on the lead aircraft. Many flight leads will use a variation of a lead-trail formation for this maneuvering, although some prefer a line abreast.

orbits until such time as everyone is ready for the next engagement[27]. At that time, a "fight's on" call is transmitted and the flights will turn towards each other if they have not done so already. At that point, the pilots will maneuver as planned to accomplish their objectives. Typically, the aggressive maneuvering associated with simulated aerial combat will take place toward the center of the area after the flights merge well away from the starting points.

(b) Specify whether the air space in Sevier B MOA near the proposed PFSF is authorized for conducting low altitude training, air-to-air combat training, and major exercises and if such exercises have been performed.

Response

As indicated in the Report[28], the airspace over Skull Valley is used primarily as a transition corridor for the South UTTR. Due to the small size and the shape of the airspace over Skull Valley it is not suitable for the tactical maneuvering typically associated with air-to-air combat training or surface attack training with the exception of low altitude navigation[29]. In addition, the high terrain on both sides further restricts the utility of the airspace, particularly that below 5,000 ft. AGL (Sevier B MOA), for tactical maneuvers other than low level navigation. Low level navigation at 1,000 ft. AGL (the minimum altitude in Skull Valley north of English Village) is a low risk event involving monitoring position, maintaining visual contact with your other flight members, and general situation awareness concerning the flight.

According to the U.S. Air Force, the preponderance of flights transiting Skull Valley use Sevier B MOA with a maximum altitude of 9,500 ft. MSL or 5,000 ft. AGL. Therefore, although not practical for the reasons stated above, only LIMITED[30] intercept maneuvering would be authorized if pilots were to attempt tactical air-to-air training in Skull Valley. LIMITED intercept maneuvering restricts pilots to a maximum of 180° of offensive or defensive turns, it prohibits exaggerated vertical maneuvering, and requires a minimum airspeed of 350KIAS[31]. This is significantly different from the UNRESTRICTED maneuvering associated with aggressive air-to-air combat training commonly referred to as "dog fighting" which must be conducted above 5,000 ft. AGL[32]. PFSF is unaware of any flights conducting intercept training in Skull Valley.

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[27] If for any reasons the pilots within a flight do not have visual contact with each other, they will maintain altitude separation until establishing visual contact. Pilots will use their radar, other onboard systems, and geographic references to aid them in establishing visual contact.

[28] Aircraft Crash Impact Hazard at the Private Fuel Storage Facility, August 10, 2000 (Revision 4), Tab E

[29] PFS is unaware of any unique restrictions on the types of maneuvering that can be conducted over Skull Valley except for the minimum altitude of 1,000' AGL.

[30] AFI 11-214, 23 February 1997, *Aircrew, Weapons Director, and Terminal Attack Controller Procedures for Aircrews,* para 5.2.8.2

[31] AFI 11-2F-16 Volume 3, 1 July 1999, *F-16 Operations Procedures*, paragraph 5.3.2

[32] AFI 11-214, 23 February 1997, *Aircrew, Weapons Director, and Terminal Attack Controller Procedures for Aircrews*, paragraphs 5.2.7.1 and 5.2.8.1

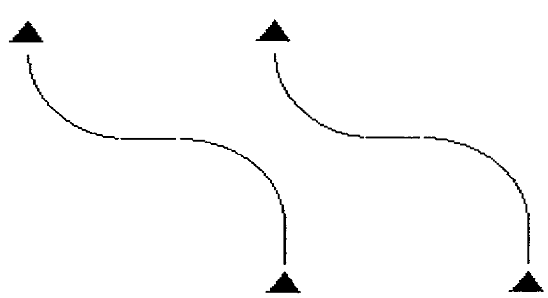
The airspace above Skull Valley is not suitable for large force exercises except for use as the southern UTTR access corridor previously discussed. Large force exercises typically involve twelve or more aircraft and require larger amounts of airspace for maneuvering purposes than the typical flight of two or four aircraft. Thus, Skull Valley is not suitable for the large force exercise tactical maneuvering such as intercepts or simulated bombing attacks. This type of training is conducted in the larger, more suitable areas of the UTTR.

(c) Describe the consequences if a pilot fails to withstand G forces or if the pilot's anti-G suit does not operate properly during G-awareness maneuvers in Skull Valley.

Response

A G Awareness maneuver is a series of two turns. A typical G Awareness series in Skull Valley would consist of the following steps. First, the leader would direct his flight members into one of several "spread out" formations. Distance between flight members is generally a few thousand feet up to approximately two miles. Second, the flight will accelerate to approximately 425 kts. Although there is no prescribed initiating airspeed, pilots will generally start the turn with the airspeed between 400KCAS (kts. calibrated airspeed) and 450KCAS. Pilots will then roll into approximately 90° of bank, advance the throttle to military power (maximum power without using the afterburner), and start a 4-5 G turn for 90 degrees. They then roll-out, accelerate, and start a second 90 degree turn normally in the opposite direction. After the second turn, the maneuver is complete and they are back on the original heading.

FINISH



START Typical G Awareness Maneuver

As noted in the aircraft hazard Report by the Air Combat Command Chief of Safety[33], "G Awareness turns are not high risk, but merely a warm-up exercise…". This is supported by Col.

[33] HQ ACC Chief of Safety Memorandum 15 Oct 99, Aircraft Crash Impact Hazard at the Private Fuel Storage Facility, August 10, 2000 (Revision 4), Tab F

Fly's (USAF, retired) memorandum[34] which indicates that G Awareness turns fall into the "...routine and administrative categories, both of which are low risk phases of flight."

The 4-5 G's experienced for a relatively short period of time during these maneuvers are easily tolerated by the pilots. Pilots undergo extensive training on how to withstand high G forces for longer time periods. This training includes academic sessions, centrifuge training during which pilots are subjected to 8-9 G's for up to 20 seconds and videotaped for debriefing purposes, and periodic monitoring of proper breathing techniques by reviewing mission videotapes. Pilots routinely experience significantly higher G forces, typically 7+ G's, during simulated aerial combat maneuvering.

In the event a pilot's G suit did not perform normally during a G awareness turn, he would not be at risk during the maneuver. The maneuvers are designed to check for proper G suit operations at a low enough G loading, that given the pilot's ability to sustain G forces, the maneuver can ensure everything is working properly without putting the pilot at risk. If the G suit did not perform properly, the first thing a pilot would do is to check his G suit connections. An improperly connected G suit or a pinched connection hose are the most probable cause of a failure. Actual failure of the pressured air system that inflates the G suit is rare. If the pilot determined that it has failed, his actions would depend upon the rest of the mission. If the remainder of the mission was benign, such as medium altitude tactics, employing laser guided bombs, the mission may be continued without any changes. Conversely, if the mission was planned as simulated air-to-air combat, which normally involves sustained high G maneuvering, the mission profile may be modified to less demanding intercepts without any simulated air-to-air combat. If the pilot was part of a larger flight and changing everyone's mission was unacceptable, the pilot may depart from the rest of the flight and complete an alternate mission such as instrument training. It is worth reiterating that this failure of the G system is rare.

[34] October 21, 1999 Memorandum, Aircraft Crash Impact Hazard at the Private Fuel Storage Facility, August 10, 2000 (Revision 4), Tab E

AIRCRAFT ORDNANCE

7. Provide the following items which are related to the effect on the aircraft crash probability at the proposed PFSF from aircraft ordnance:

(a) Provide a breakdown of the live and inert ordnance (e.g., numbers of each type such as MK84, CBU, etc.) carried by F-I6 aircraft while transiting through Skull Valley in FY 2000, including the number of flights that carried each type.

(b) Specify whether the same types and proportional mix of ordnance were used in both FY 2000 and FY 1998.

Response

Questions 7(a) and (b) will be answered upon the receipt of responses to PFS Freedom of Information Act (FOIA) requests to the U.S. Air Force.

(c) Describe a typical impact angle of an ordnance dropped from an F-16 and compare it to the impact angle of an F-16 crash.

Response

The impact angle, as measured from the horizontal, of ordnance dropped from an F-16 in Skull Valley will vary by the altitude at which it is released, whether the plane is in level flight or climbing, and the speed of the aircraft at the point of release. Other things being equal, the higher the altitude, the steeper the angle of impact. Using level flight as a reference, if the plane is climbing, the impact angle will be steeper (because of lofting the ordnance). Again, other things being equal, the faster the aircraft as the point of jettisoning, the shallower the impact angle.

F-16s in Skull Valley generally fly 350 to 400 knots and 3,000 ft. to 4,000 ft. AGL in level flight. (Aircraft Crash Impact Hazard at the Private Fuel Storage Facility (Report), page 19b). There may of course be some flights at lower altitudes, down to 1,000 ft. AGL or if the Sevier D MOA airspace is used, up to 14,000 ft. AGL.

Using the conservative bounds of the generally flown speeds and altitudes, 400 knots at 3,000 ft., the impact angle of a Mark 84 2,000-pound bomb would be 34 degrees (i.e., 56 degrees from the vertical), as measured by the Joint Munitions Effects Manual Trajectory Model, given by the Joint Technical Coordinating Group, Eglin AFB, FL. If the aircraft had engine failure and was beginning a zoom maneuver to climb at a 30-degree angle and was in a 15 degree climb at the point of release, the impact angle would be 37 degrees. PFS therefore feels that an angle in this range (34 to 37 degrees, or 53 to 56 degrees from the vertical) would be appropriate as a typical impact angle.

The impact angle of the Mark 82 500-pound bomb is essentially the same as the angle for the 2,000-lb. bomb if it is jettisoned singly. Both it and the Mark 84 will descend in a streamlined fashion because of their fin design and will achieve the lowest drag trajectory and therefore the shallowest impact angle possible. However, if Mark 82 bombs (3) were to be carried on a Triple Ejector Rack (TER), as is normally done, the entire rack and bomb assembly would be jettisoned as a unit with all three bombs still attached to the rack. Because the TER is a suspension device and was not designed for free-fall ballistic flight, the TER with the bombs attached would not streamline and would slow down quickly resulting in a steepening of the impact angle.

The net effect on the effective area of the PFSF (see pages 80-81 of the Report) of considering the impact angle of jettisoned ordnance is negligible. Assuming an impact angle of 34 degrees from the horizontal (the flattest of the impact angles discussed above), the depth of the cask storage area (the dimension of the cask storage area along the F-16 flight path and hence the trajectory of the jettisoned ordnance) would increase by an amount equal to the height of a spent fuel storage cask divided by the tangent of the impact angle. The height of a storage cask is 19.6 ft. (Report p. 15). The tangent of 34 degrees is 0.675. Thus, the cask storage area effective depth would increase by 29.1 ft (19.6 ft./0.675). The depth of the cask storage area is 1,590 ft. (Report p. 82). Thus, considering the impact angle of jettisoned ordnance increases the effective depth of the cask storage area, and hence the effective area of the cask storage area, at most, by 1.8 percent ((1,590 + 29.1)/1,590).

The impact angle, as measured from the horizontal, of the F-16 itself during an inflight crash was taken from Accident Analysis for Aircraft Crash into Hazardous Facilities, DOE STD-3014-96 (1996) and is 6 degrees 50 minutes. (Page B-29). The cotangent of this angle was used in PFS's calculation of effective areas. (Report, page 15). This number was developed in the Data Development Technical Support Document for the Aircraft Crash Risk Analysis Methodology (ACRAM) Standard (1996) through the study of many small military aircraft crashes. (ACRAM Pages 4-23 and 4-24).

WIDTH OF USABLE AIR SPACE

8. Specify the width of usable air space in Skull Valley at the navigational latitude where the proposed site would be located and at a point 10 miles north of the proposed site.

> This information pertains to the relationship of usable air space to the aircraft crash probability at the proposed PFSF.

Response

The Sevier B MOA in Skull Valley is 12 statute miles wide at the latitude of the PFSF. (Aircraft Crash Impact Hazard at the Private Fuel Storage Facility (Report), page 6) At this latitude, the PFSF sits in the Valley at a point 2 miles to the east of the western boundary of the MOA, at an altitude of 4,500 ft. MSL. The top of the MOA is established at 9,500 ft. above sea level (MSL). Air Force Instructions pertinent to the UTTR establish a floor at 1,000 ft. AGL below which aircraft may not fly through Skull Valley. Rising terrain on the east side of the MOA intersects the top of the MOA 10 miles to the east of the PFSF at 9,500 ft. MSL (5,000 ft. above the PFSF) at the MOA's eastern limit (see Report, Figure 1. Note the greatly exaggerated vertical scale (representing less than 1 mile of altitude) on this figure). Because of the rising terrain, flight is not practical at all altitudes from 1,000 ft. to 5,000 ft. above the PFSF for the entire width of the MOA. While an F-16 could in fact fly in the MOA airspace at a point over 9 miles east of the PFSF, implying a usable width of the airway of over 11 miles, PFS has chosen to assume a more conservative 10 mile value for the usable width.

TAB A of the Report depicts Sevier B MOA in Skull Valley. The northern border of the MOA, which slants from its northwestern tip in an east-southeasterly direction in the Valley, is 17.5 statute miles long. The eastern edge then goes southward in a straight line along the Stansbury Mountains ridge while the western edge slants to the southeast, closing on the eastern edge until it reaches a point 10 statue miles south of the PFSF, east of the valley road and near English Village on Dugway Proving Ground.

If F-16s do fly above the Sevier B MOA, in the Sevier D MOA airspace, they are not constrained by the terrain and hence have the full 12 mile width of the MOA available as usable airspace. In fact, if the pilots were operating under visual flight rules (VFR) above Sevier B, they could fly to the east of the Stansbury mountains (i.e., to the east of the MOA) if needed or desired, using an even wider airway width.

At a latitude 10 statute miles north of the PFSF, the eastern edge of the Valley is just north of the northern boundary of the Sevier B MOA (i.e., the edge of the Valley is outside the MOA). Measuring from the western edge of the MOA (which is up against the Restricted area R-6406B) at this latitude to the other side of the valley at the crest of the Stansbury Mountains in the east, the distance is 17.0 statute miles. (The valley itself is 18.2 statute miles wide, ridge to ridge from the Stansbury Mountains to the Cedar Mountains, but F-16s cannot use the westernmost 1.1 miles because of the restricted area R-6406B).

Beginning on the west side of the Valley, in the MOA and next to the Cedar Mountains, the terrain is at 5,500 ft. MSL. It drops to 4,500 ft. in 3.7 statute miles and is generally flat for 7.2 miles, reaching a low of about 4,300 ft. at the floor of the valley. At a point 10.9 miles from the western edge of the Valley, it begins a rise from 4,500 ft. to 5,500 ft. in 2.7 miles. It levels at just above 5,500 ft. for 0.3 miles, then climbs again over the next 3.1 miles to reach 8,000 ft. MSL at the crest of the Stansbury Mountains. Because of this geometry at this latitude, the entire width of the MOA is usable airspace. In addition, the portions of the airspace just to the north of the MOA are not limited by the MOA maximum altitude, although in practice aircraft transiting the Valley will be close to or below it because of the short distance until they are in the MOA.

At a latitude 10 statute miles south of the PFSF, the Sevier B narrows to its narrowest width. At this latitude it is 7.1 statute miles wide. Hence, within a north-south distance of 20 statute miles, the MOA has narrowed by almost 10 statute miles.

The terrain within the MOA here is basically flat. At the western edge of the MOA it is at about 4,800 ft.. It rises to 5,000 ft. in 4.6 sm., then continues a gradual climb to 5,800 ft at the eastern edge of the MOA. Hence, the entire width of the MOA at this latitude is usable airspace.

CLOUD COVER

9. Provide the following items which are related to the aircraft crash probability at the proposed PFSF from cloud cover in the Skull Valley region:

(a) Define and discuss the meaning of "5/10 cloud cover" as referenced in Cole et al.

Response

Weather is measured in terms of cloud cover and visibility. Cloud cover is normally reported in feet above ground level and the percent of sky covered (in eighths or tenths). 5/10 cloud cover means five tenths (half) of the sky is covered by clouds at some specified altitude Above Ground Level (AGL). This represents a summation of cloud cover up to that altitude where it covers half the sky. For example, 2/10th's cloud cover at 3,000 ft. AGL and 3/10th's cloud cover at 5,000 ft. AGL would constitute 5/10th's cloud cover at 5,000 ft. AGL with half the sky covered at 5,000 ft. AGL. A "ceiling" is defined as the summation of sky cover totaling <u>more than</u> half the sky, and is labeled "broken" or "overcast." Department of Transportation/Federal Aviation Administration Order 7900.5A defines "broken" as sky cover 5/8th's to 7/8th's and "overcast" as sky cover of 8/8th's. Air Force Manual 15-111 defines "broken" as "a summation of sky cover of 5/8th's through less than 8/8th's" and "overcast" as "a summation of sky cover of 8/8th's."

(b) Discuss whether pilots fly under IFR or VFR rules if there is cloud cover in Skull Valley.

Response

As a general rule pilots fly under visual flight rules (VFR) in Skull Valley and on the UTTR when conducting training missions. Most tactical maneuvering for combat training requires the pilot to be VFR.

The visibility and ceiling on the UTTR are normally excellent[35]. However, it is worth noting that pilots often conduct training and maintain VFR when there are clouds present. All that is required is for the pilot to maintain the required separation from clouds. In fact, it is possible to conduct VFR operations on top of a complete undercast, if the weather above the undercast permits.

According to the Air Force, F-16s typically transit Skull Valley via the Sevier B MOA (i.e., 1,000 to 5,000 ft. AGL). As noted in the detailed Air Weather Service (AWS) ceiling and visibility data for Dugway Proving Ground, the ceiling is greater (higher) than 5,000 ft. AGL (9,500 ft. MSL in the Sevier B MOA) with 7 statute miles or greater visibility 91.5% of the time. Further, the data also shows that there is no ceiling, with a visibility of 7 statute miles, more than 70% of the time. Thus, pilots can transit through Skull Valley under visual flight rules the vast majority of the time.

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[35] Air Weather Service, Ceiling and Visibility Data for Dugway Proving Ground (attached).

To remain under VFR in Skull Valley, the pilot must have 3 miles in-flight visibility and be able to maintain clearance 500 ft. below, 1,000 ft. above, and 2,000 ft. horizontal from clouds. For example, a pilot could fly at 1,500 ft. AGL below a 2000 ft. AGL cloud deck and remain VFR. In addition, as noted above, if the clouds were all low, the pilot could fly above them and remain VFR. If the weather and cloud cover in Skull Valley are such that a pilot can not proceed VFR, then the pilot must request and secure an Instrument Flight Rules (IFR) clearance from Air Traffic Control to continue the flight. This is accomplished by contacting the nearest air traffic control facility such as Clover Control or Salt Lake City Approach Control or Salt Lake City Center. With an IFR clearance the pilot will be under radar control and receive radar separation from other aircraft. Under an IFR clearance, there is no requirement to maintain visual references, and the pilot can fly entirely in the clouds. (Source: AFR 60-16/AFI 11-206, 25 JUL 94). However, because of the high terrain on both sides of Skull Valley, the minimum IFR altitude for a significant portion of the valley must high enough to keep the pilots safely above the Stansbury and Cedar mountain ranges.

(c) Discuss whether the pilot can use radar to seek through cloud cover and aim the aircraft at a particular target.

Response

The radar does penetrate clouds and can be used to identify targets and other features on the ground. If the PFSF was programmed as one of the INS destinations (also referred to as steer points) and it was the currently selected destination[36], the site should be readily identifiable on the radar screen by the pilot. In the event the PFSF was not the currently selected INS destination, the PFSF may or may not be identifiable on the radar screen depending upon the location of the steer point and the current aircraft position.

The quality of the radar image depends on multiple factors including, but not limited to; distance to the target, vertical development of the target, target composition (type of materials), surroundings (water, buildings, hills, forests, etc.), approach heading, radar look angle (elevation and azimuth), etc. The ground map radar tends to be most useful at relatively shallow elevation angles, typically in the 0° to -15° range.

The F-16 radar has three basic submodes while operating in the ground map mode; ground map, expand, and doppler beam sharpening (DBS). In the basic ground map mode, the radar shows things such as land/water contrast and cultural returns (primarily buildings, roads may or may not show up). There is little clear definition to buildings, etc. even if they are relatively isolated. Buildings and other man made objects typically display as a few pixels that are brighter than those depicting ground returns. This enables the pilot to identify the building but it doesn't provide clear definition of the building shape.

[36] In the ground map mode, the radar will automatically center its sweep over the INS destination. Therefore, the PFSF structure should be identifiable on the radar scope.

The expand submode basically magnifies the area of interest as identified by the radar cursors[37] which the pilot controls[38]. In expand, it is easier to more precisely position the radar cursors if they are closely positioned to the intended steerpoint prior to selecting expand. Cultural returns tend to "bloom" in the expand mode which often makes it difficult to identify other objects within the field of view.

In the doppler beam sharpening mode, the radar presentation begins to look like a picture. Roads, buildings and other objects can start to be identified. Because of the way DBS is mechanized, the target must be a minimum of 5° off the nose for the system to work. The resolution improves by a factor of approximately eight when the target moves from 5° to at least 15° off the aircraft nose. The radar can be used to improve the INS navigation and steering cues provided to the pilot by precisely positioning the radar cursors over the designated steer point. As the radar cursors are moved, there is a proportional change in the steering cues.

(d) Discuss whether expected cloud cover at Skull Valley would be dense enough to prevent the pilots from visually locating PFSF and whether similar cloud cover would be present in ranges at UTTR South at the same time.

Response

As shown in the AWS Michael Army Airfield data, the limited cloud cover in Skull Valley allows pilots to visually locate the PFSF most of the time. As discussed in response to question 9(e), Sevier B MOA, has no ceiling, with 7 or more miles visibility, 91.5% of the time and it is the primary route airspace used while transiting Skull Valley. Furthermore, as also discussed in response to questions 9(a) above and 9(e) below (and as shown in the figures), a ceiling does not necessarily indicate a solid layer of clouds (i.e., an overcast). Thus even if a ceiling were present, it is possible that a pilot could see the PFSF site on the ground. Therefore, pilots should be able to visually locate the site the majority of the time. It is conceivable, however, that even though there is not enough cloud cover to constitute a ceiling, a cloud could be positioned to preclude visual contact with the PFSF at a particular moment. Clouds are generally dense enough that you can not see through them.

The weather conditions in Skull Valley are similar to those at Michael AAF and the South UTTR. However, the UTTR is large enough that the weather conditions may change as you get further away from Skull Valley.

(e) Examine the historical records for cloud cover in the UTTR and determine whether the UTTR South range would remain open for combat training under such weather events.

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[37] In the ground map mode, the radar cursors are normally automatically positioned over the selected Inertial Navigation System (INS) steerpoint or destination. The cursors consists of one vertical and one horizontal line on the radar display. They show the steerpoints relative azimuth and range from the nose of the aircraft. The cursor intersection represents the steerpoint position. The pilot may manually move and reposition the radar ground cursors if he so desires.

[38] Expand is a 4:1 expansion of the normal radar image.

Response

The detailed ceiling and visibility information for Michael AAF is a reasonable approximation for the weather in Skull Valley and the southern UTTR as discussed in the previous question. Figure 9-1[39] shows the vertical segregation of the airspace over Skull Valley with the associated historical ceiling and visibility for Sevier B MOA (ceiling above the MOA, visibility greater than 7 miles, 91.5% of the time) and the Positive Controlled Airspace (PCA) (no ceiling conditions observed, visibility greater than 7 miles, 70.5% of the time).

Figures 9-2 through 9-5 are examples of representative cloud coverage conditions[40] that could occur in the no ceiling and 7sm visibility conditions category. As shown in some of the examples, "no ceiling" does not necessarily mean "no clouds". A ceiling is defined as a cumulative coverage of 5/8ths (five eighths or approximately 60%). When there is no ceiling present, conditions are favorable for VFR operations.

Figures 9-9 through 9-12 show examples of the ceiling and visibility which correspond to the Sevier B MOA. As can be seen from the AWS data, this is the prevailing ceiling and visibility condition 91.5% of the time. In essence, pilots should be able to maintain VFR in the Sevier B MOA the vast majority of the time.

Figures 9-6 through 9-8 are examples of the ceiling and visibility at 14,000 ft. AGL, which is 500 ft. above the Positive Control Airspace[41] (which begins at 18,000 ft. MSL). Note that if there is "no ceiling," there is also no ceiling at 14,000 ft. By comparing the AWS data for ceiling above 14,000 ft. AGL with the no ceiling data, it can be deduced that only approximately 4% of the time is there a ceiling above 14,000 ft. AGL. Although there may be clouds below 14,000 ft. MSL, the lack of a ceiling at 14,000ft. with 7sm visibility indicates VFR operations can be conducted approximately 74% or more of the time.

As discussed in response to question 9(b), if there is a cloud layer or layers that preclude pilots from operating at specific altitudes, then they may operate VFR above or below those cloud layers as long as they meet the VFR weather requirements. Thus the presence of a ceiling does not necessarily prohibit VFR operations. As can be seen from the historical weather data, pilots have the option to fly through Skull Valley VFR approximately 91% or more of the time.

In the event weather conditions precluded VFR operations in Skull Valley, it is reasonable to assume that similar weather conditions would be present in the adjoining UTTR airspace. Therefore, you would anticipate the fighter squadrons would reduce their flying

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[39] Note that the horizontal distance between the Stansbury and Cedar mountains is not to scale. The distance between the mountain ranges varies from approximately 18nm in the north to about 7nm in the southern neck of Skull Valley.

[40] These are illustrative examples and are only intended to show some of the different types of cloud coverage conditions that could fall within the different ceiling and visibility categories.

[41] Flight in the PCA requires an IFR clearance unless operating in special use airspace such as a MOA or restricted airspace that extends above 18.000' MSL. Sevier B is the predominant route of flight through Skull Valley. If a pilot were to elect to fly VFR above Sevier B he must remain below 18,000' MSL to avoid the PCA.

activities accordingly. Since most of the tactical training requires VFR conditions, there would be little training accomplished if there was extensive vertical and horizontal cloud cover on the range. On the other hand, pilots do have requirements for instrument proficiency sorties, therefore some of those may be flown. In addition, there may be useable areas of airspace on the range that would support training for some flights.

(f) Discuss the flight restrictions during cloud cover and state whether a pilot has to fly at least 1,000 ft. below a cloud cover.

Response

As stated in response to question 9(b), to remain under Visual Flight Rules (VFR) in Skull Valley, a pilot must be able to maintain clearance at least 500 ft. below clouds. A pilot is also required, by Air Force Instructions, to maintain a minimum of 1,000 ft. AGL through Skull Valley in the vicinity of the PFSF. Consequently, a pilot could legally fly through Skull Valley at 1,000 ft. AGL with cloud cover if the ceiling (broken or overcast) cloud cover was as low as 1,500 ft. AGL.

As discussed in response to question 9(h) below, pilots may operate VFR above the clouds and maintain their positional awareness using on board systems. F-16s routinely operate VFR over clouds when required. It is routine, particularly in locations such as Germany, Korea and parts of the U.S. where there is more cloud cover than in Utah.

(g) Discuss whether a pilot experiencing engine trouble could avoid the proposed PFSF if there were a cloud cover at 3,000 ft. above ground level.

Response

A pilot would be able to avoid the proposed PFSF if there were a cloud cover at 3,000 feet above the ground.

If the pilot was operating VFR below the clouds and experienced engine trouble, he would have adequate time to respond to the problem and still avoid the PFSF if he was forced to eject. The amount of time available to the pilot would depend upon his altitude and airspeed when the problem occurred. Even using a "worst case" of 1,000 ft. AGL (the minimum altitude authorized in Skull Valley) and 350KCAS would provide the pilot with a minimum of 45 seconds to perform the required actions. This is more than enough time for the pilot to accurately assess his situation and make the small turn required to avoid the PFSF if he was pointing at it. Initial altitudes higher than 1,000 ft. or airspeeds greater than 350KCAS provide more time for the pilot to analyze the situation and take appropriate actions.

If the pilot is flying above a 3,000 ft. ceiling (broken or overcast) with no significant additional clouds above him, he could zoom in accordance with established procedures and after leveling off, commence airstart attempts. With a ceiling of only 3,000 ft. AGL, prominent terrain features such as the Cedar Mountains and the Stansbury Mountains, particularly Deseret Peak at 11,031 ft. would be readily visible to assist in confirming positional and situational awareness (see response to question 9(h) below). Moreover, as discussed in response to questions 9(b) and (e) above, a cloud ceiling is not necessarily a complete cloud cover (overcast) and it is possible that a pilot could see the PFSF even in the presence of a ceiling at 3,000 ft. The visual cues, coupled with navigation instrument displays would enable the pilot to steer away from the PFSF site.

(h) Provide the basis for the assertion that pilot positional awareness would be maintained when flying above the highest cloud cover by reliance on visual references to mountain ranges that are used for visual reference (e.g., will the mountain ranges extend above the highest cloud cover in Skull Valley).

Response

USAF pilots are trained to maintain situational and positional awareness at all times. They are also trained to "think ahead of the aircraft" and be cognizant of approaching terrain features or man made structures that can be used as an aid to navigation and position determination. Unless the pilot is flying above a total overcast (see 9(a) response), he will be able to see the ground to some extent. This will greatly aid in maintaining situational and positional awareness. Obviously, the pilot will be able to see more of the ground when flying above a scattered deck of clouds than a broken deck of clouds (see 9(a) response). Prominent mountain peaks can be particularly useful as well in maintaining situational and positional awareness. The Sevier B MOA extends up to 9,500 ft. MSL. Prominent mountain peaks include Deseret Peak at 11,031 ft. MSL east by northeast of the proposed PFSF site and the two peaks bounding Johnson Pass to the southeast of the proposed PFSF site at 10,330 ft. MSL to the north of the pass and 9,020 ft. MSL south of the pass. Deseret Peak is obviously the most visible followed by the other two peaks. Deseret Peak would also obviously be visible above a cloud deck at approximately 10,000 ft. MSL in the vicinity of the proposed PFSF site. Consequently, an F-16 pilot flying at 9,500 ft. MSL above a cloud deck at the very top of the Sevier B MOA would be able to see Deseret Peak and use it as a visual aid in determining situational and positional awareness. When a pilot is flying above cloud decks that are lower than 9,500 ft. MSL, Deseret Peak would be even more visible, and there will obviously be other prominent terrain features available, such as the two peaks bounding Johnson Pass.

In the event of an emergency, a pilot would be able to avoid the proposed PFSF site because of situational and positional awareness of where his aircraft is and where it is heading. The pilot would be able to do this without having to actually see the site itself, because he would know where it is relative to his known location.

The pilot 's ability to determine situational and positional awareness has improved continually over time due to constantly improving navigational equipment and better training. In years past, pilots flying propeller driven fighter aircraft and propeller driven transport aircraft often flew low level with no navigational aid assistance whatsoever and maintained situational and positional awareness by visual reference to the terrain alone. They also knew the locations of prominent terrain features such as mountain peaks and man made structures such as communications towers and were able to avoid them even in the event of adverse weather and inflight emergencies.

Today's pilots have far superior navigation equipment and better training than in years past to maintain situational and positional awareness and avoid prominent terrain features and man made structures. The F-16 has the TACAN (Tactical Air Navigation) System that provides bearing and distance information from the particular ground station that is selected at a given time. In addition, the F-16 is equipped with an INS (Inertial Navigation System). The INS is self-contained and uses a series of gyros to maintain a current position and flight direction and velocity. The INS can be used to either navigate to/from a selected set of latitude and longitude coordinates or maintain awareness of those coordinates' location. Some models of the F-16 are also equipped with a GPS (Global Positioning System) receiver. This uses the satellite navigation constellation to maintain positional awareness and help fine tune the INS position. During a typical mission pilots will use both visual references and on-board navigation systems in tandem to maintain their situational and positional awareness. Weather permitting, they will use prominent geographic features for general awareness and smaller features for more precise positioning while cross-checking and confirming their position using on-board systems such as TACAN and INS.

Air Weather Service Ceiling and Visibility Data for Dugway Proving Ground

:STA 690110 | DPG | DUGWAY PROVING GROUND , ,US
:LAT 40 12N :LONG 112 56W :ELEV 4349(ft) 1326(m) :TYPE AWS SCT V2.0 11051992
Percent Frequency of CEILING versus VISIBILITY (from HOURLY obs)

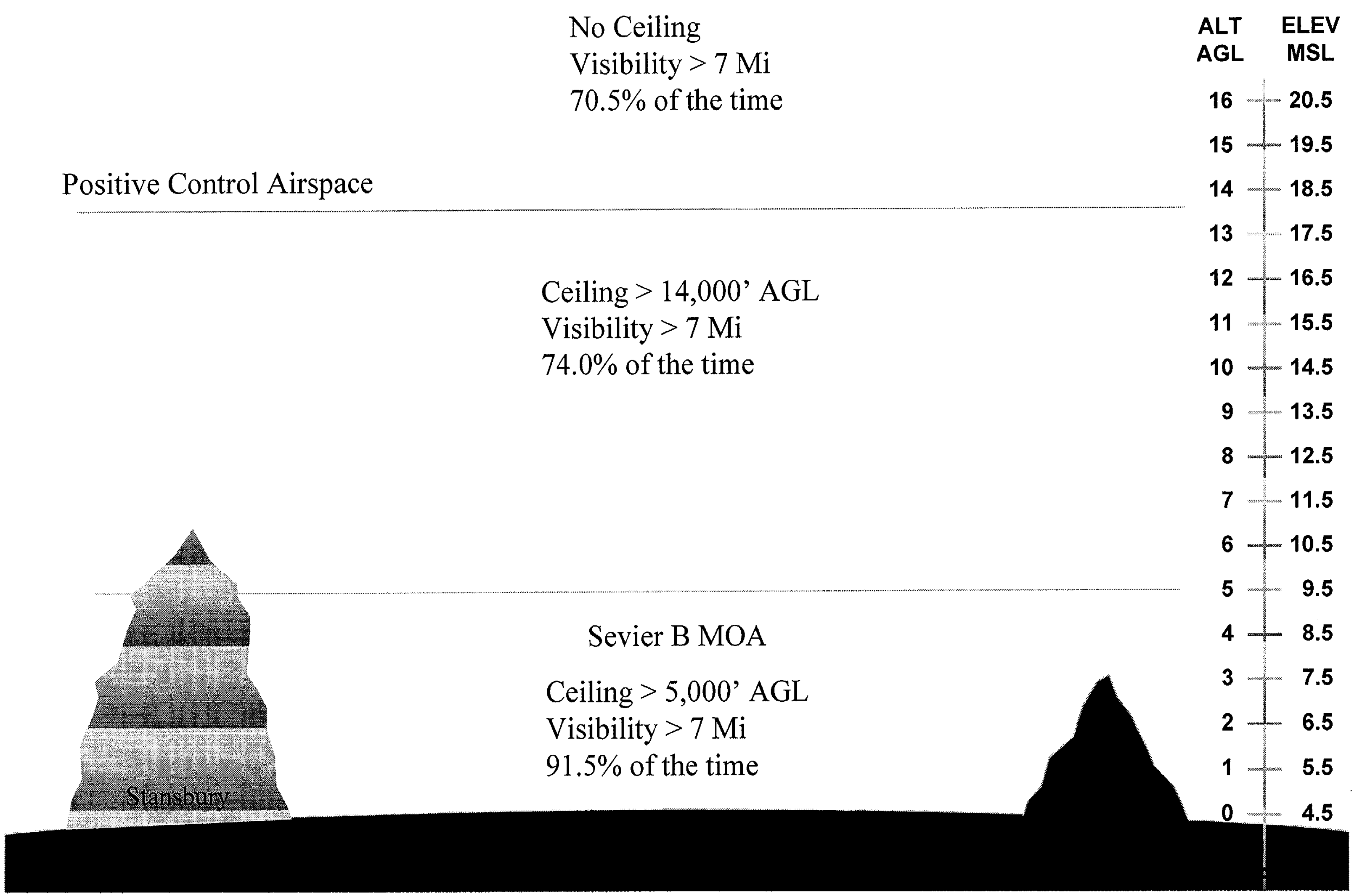
ALL

CEILING IN FEET	VISIBILITY IN STATUTE MILES GE 7	GE 6	GE 5	GE 4	GE 3	GE 2 1/2	GE 2	GE 1 1/2	GE 1 1/4	GE 1	GE 3/4	GE 5/8	GE 1/2	GE 3/8	GE 1/4	GE 0
NO CEIL	70.5	70.6	70.7	70.8	70.8	70.8	70.9	70.9	70.9	70.9	70.9	71.0	71.0	71.0	71.0	71.1
GE 20000	72.3	72.3	72.4	72.5	72.6	72.6	72.6	72.7	72.7	72.7	72.7	72.7	72.7	72.8	72.8	72.9
GE 18000	72.5	72.5	72.6	72.7	72.8	72.8	72.8	72.8	72.8	72.9	72.9	72.9	72.9	73.0	73.0	73.0
GE 16000	72.7	72.8	72.9	73.0	73.0	73.1	73.1	73.1	73.1	73.1	73.2	73.2	73.2	73.2	73.3	73.3
GE 14000	74.0	74.1	74.2	74.3	74.3	74.3	74.4	74.4	74.4	74.4	74.5	74.5	74.5	74.5	74.5	74.6
GE 12000	77.1	77.2	77.3	77.4	77.4	77.4	77.5	77.5	77.5	77.5	77.6	77.6	77.6	77.6	77.6	77.7
GE 10000	80.4	80.5	80.7	80.8	80.8	80.9	80.9	80.9	80.9	81.0	81.0	81.0	81.0	81.0	81.1	81.1
GE 9000	81.6	81.7	81.8	81.9	82.0	82.0	82.0	82.1	82.1	82.1	82.1	82.1	82.2	82.2	82.2	82.3
GE 8000	83.6	83.7	83.8	83.9	84.0	84.0	84.1	84.1	84.1	84.1	84.2	84.2	84.2	84.2	84.3	84.3
GE 7000	85.6	85.7	85.8	85.9	86.0	86.1	86.1	86.1	86.1	86.2	86.2	86.2	86.2	86.2	86.3	86.3
GE 6000	88.6	88.7	88.9	89.0	89.1	89.1	89.2	89.2	89.2	89.2	89.3	89.3	89.3	89.3	89.4	89.4

GE 5000	91.5	91.6	91.8	91.9	92.0	92.1	92.1	92.2	92.2	92.2	92.2	92.2	92.3	92.3	92.3	92.4
GE 4500	92.1	92.3	92.5	92.6	92.7	92.8	92.8	92.9	92.9	92.9	92.9	92.9	93.0	93.0	93.0	93.1
GE 4000	93.4	93.6	93.8	94.0	94.1	94.2	94.2	94.3	94.3	94.3	94.4	94.4	94.4	94.4	94.5	94.5
GE 3500	94.1	94.3	94.5	94.7	94.9	94.9	95.0	95.0	95.0	95.1	95.1	95.1	95.2	95.2	95.2	95.3
GE 3000	95.0	95.2	95.5	95.7	95.9	96.0	96.1	96.1	96.1	96.2	96.2	96.2	96.3	96.3	96.3	96.4
GE 2500	95.5	95.7	96.0	96.3	96.5	96.5	96.6	96.7	96.7	96.8	96.8	96.8	96.9	96.9	96.9	97.0
GE 2000	95.8	96.1	96.5	96.8	97.0	97.1	97.2	97.2	97.3	97.4	97.4	97.4	97.5	97.5	97.5	97.6
GE 1800	95.9	96.1	96.5	96.8	97.1	97.1	97.2	97.3	97.3	97.4	97.5	97.5	97.5	97.6	97.6	97.7
GE 1500	96.0	96.3	96.8	97.1	97.4	97.4	97.6	97.7	97.7	97.8	97.9	97.9	97.9	98.0	98.0	98.1
GE 1200	96.1	96.4	96.9	97.3	97.6	97.6	97.8	97.9	97.9	98.1	98.1	98.1	98.2	98.2	98.3	98.3
GE 1000	96.2	96.5	97.1	97.4	97.8	97.9	98.1	98.2	98.2	98.4	98.4	98.5	98.5	98.6	98.6	98.7
GE 900	96.2	96.6	97.1	97.5	97.9	97.9	98.1	98.2	98.3	98.5	98.5	98.5	98.6	98.7	98.7	98.8
GE 800	96.3	96.6	97.2	97.6	97.9	98.0	98.2	98.3	98.4	98.6	98.7	98.7	98.8	98.8	98.9	98.9
GE 700	96.3	96.6	97.2	97.6	98.0	98.1	98.3	98.4	98.5	98.7	98.8	98.8	98.9	99.0	99.0	99.1
GE 600	96.3	96.6	97.2	97.7	98.1	98.1	98.4	98.5	98.6	98.8	98.9	98.9	99.1	99.1	99.2	99.3
GE 500	96.3	96.6	97.2	97.7	98.1	98.2	98.5	98.6	98.7	98.9	99.0	99.0	99.2	99.3	99.4	99.5
GE 400	96.3	96.7	97.3	97.7	98.1	98.2	98.5	98.6	98.7	98.9	99.1	99.1	99.3	99.3	99.5	99.7

GE 300	96.3	96.7	97.3	97.7	98.1	98.2	98.5	98.6	98.7	98.9	99.1	99.1	99.3	99.4	99.6	99.8
GE 200	96.3	96.7	97.3	97.7	98.1	98.2	98.5	98.6	98.7	98.9	99.1	99.1	99.3	99.4	99.6	99.9
GE 100	96.3	96.7	97.3	97.7	98.1	98.2	98.5	98.6	98.7	98.9	99.1	99.1	99.3	99.4	99.6	100.0
GE 000	96.3	96.7	97.3	97.7	98.1	98.2	98.5	98.6	98.7	98.9	99.1	99.1	99.3	99.4	99.6	100.0

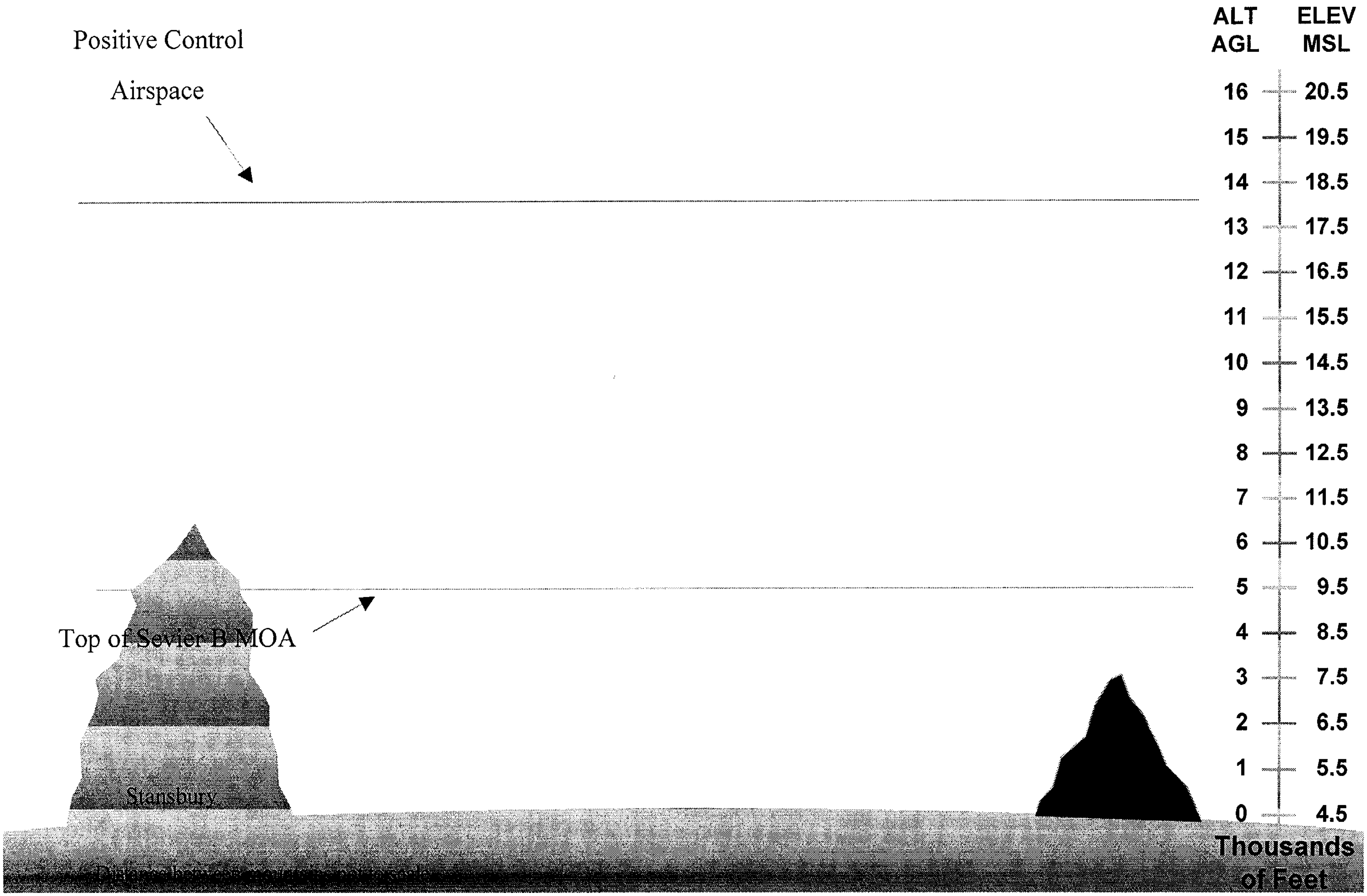
Skull Valley Airspace (Fig. 9-1)



Skull Valley Airspace (Fig. 9-2)

No Ceiling and Visibility> 7 Statute Miles, 70.5% of the time

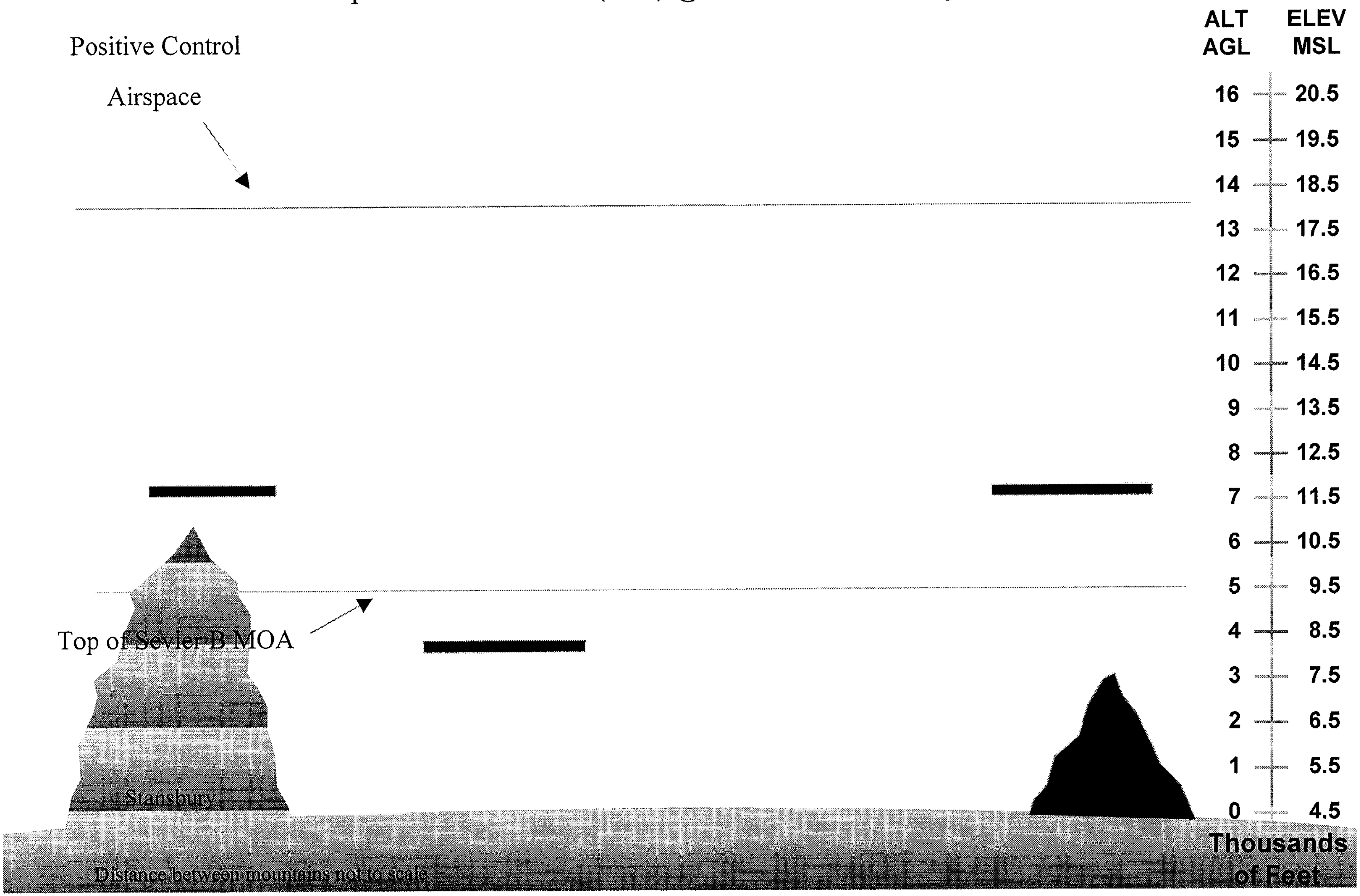
Depicted Weather: Sky Clear (no clouds)



Skull Valley Airspace (Fig. 9-3)

No Ceiling and Visibility> 7 Statute Miles, 70.5% of the time

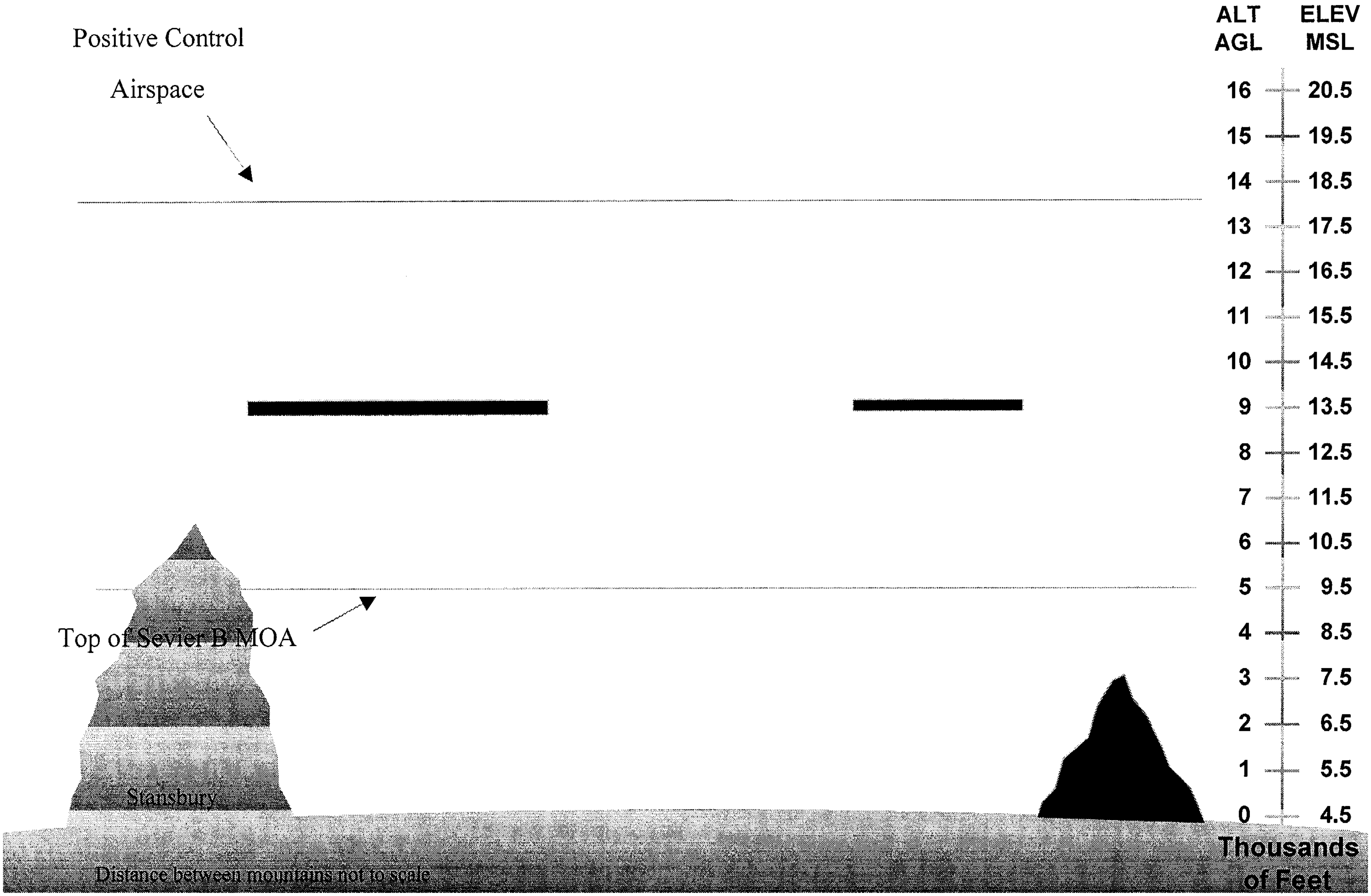
Depicted Weather: 1/8 (Few) @ 4,000', 2/8 (Few) @ 7,000'



Skull Valley Airspace (Fig. 9-4)

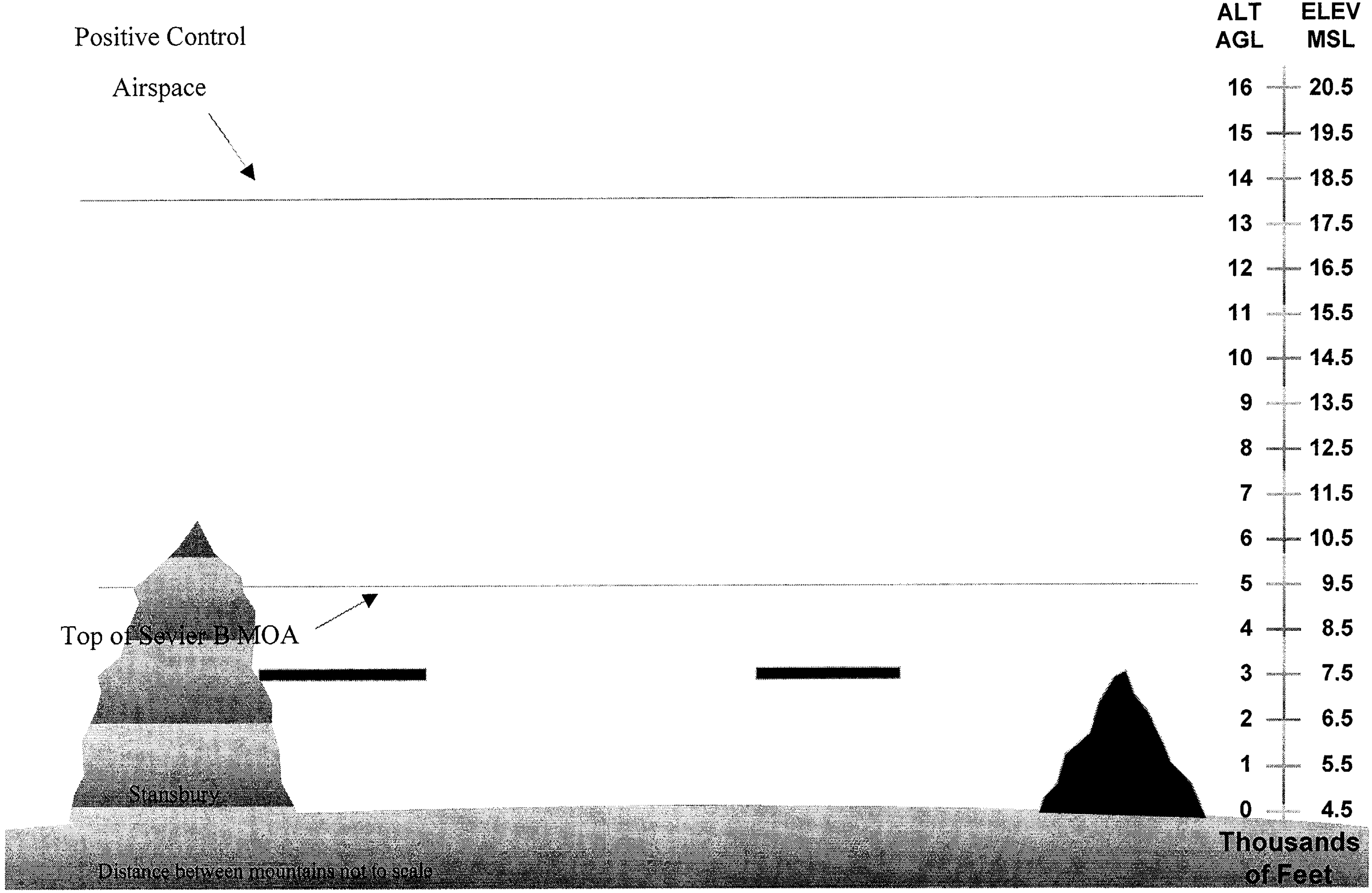
No Ceiling and Visibility> 7 Statute Miles, 70.5% of the time

Depicted Weather: 3/8 (Scattered) @ 9,000'



Skull Valley Airspace (Fig. 9-5)

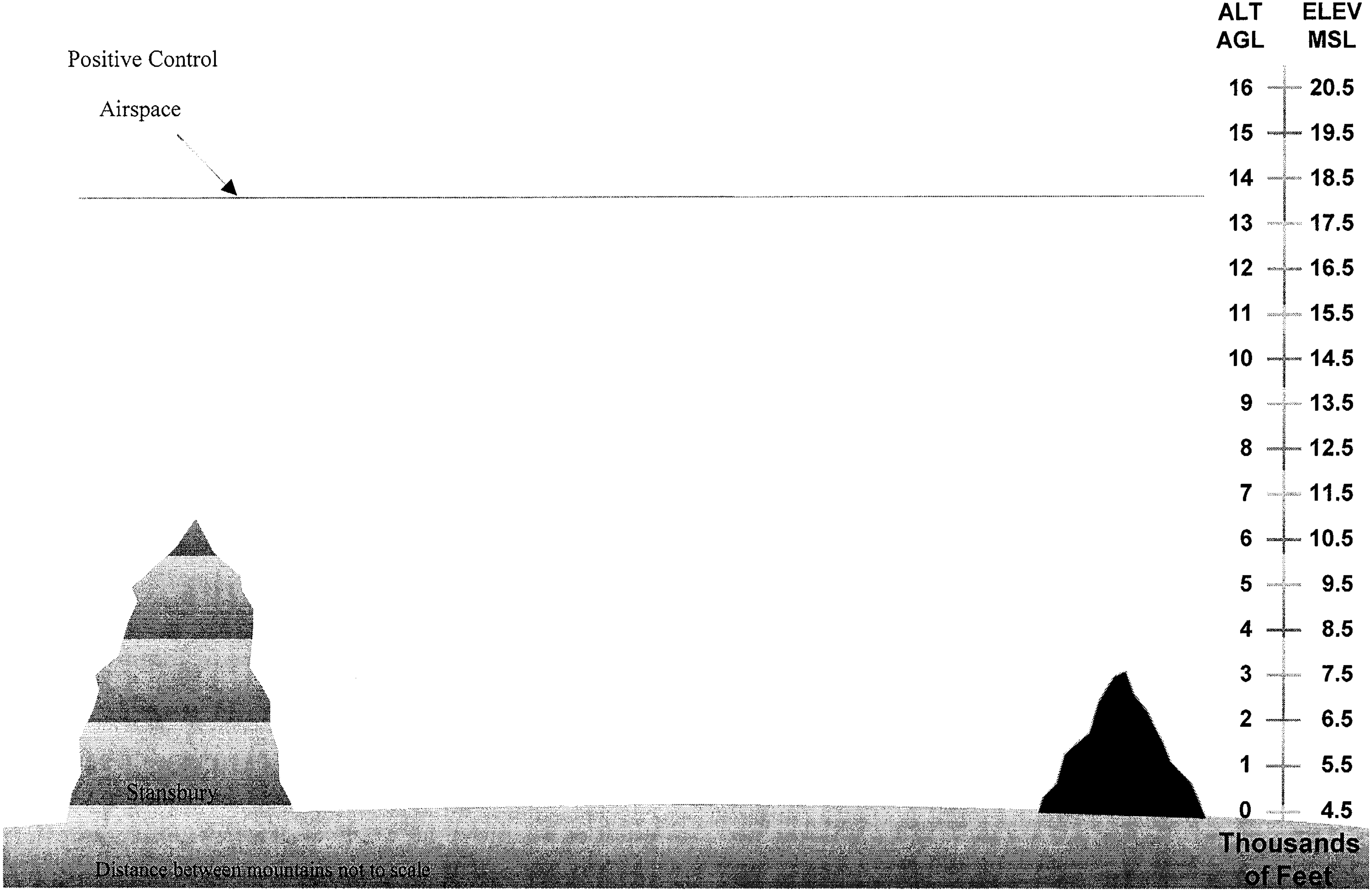
No Ceiling and Visibility> 7 Statute Miles, 70.5% of the time
Depicted Weather: 2/8 (Few) @ 3,000'



Skull Valley Airspace (Fig. 9-6)

Ceiling > 14,000' & Visibility > 7 Statutes Miles, 74.0% of the time

Depicted Weather: Clear Sky

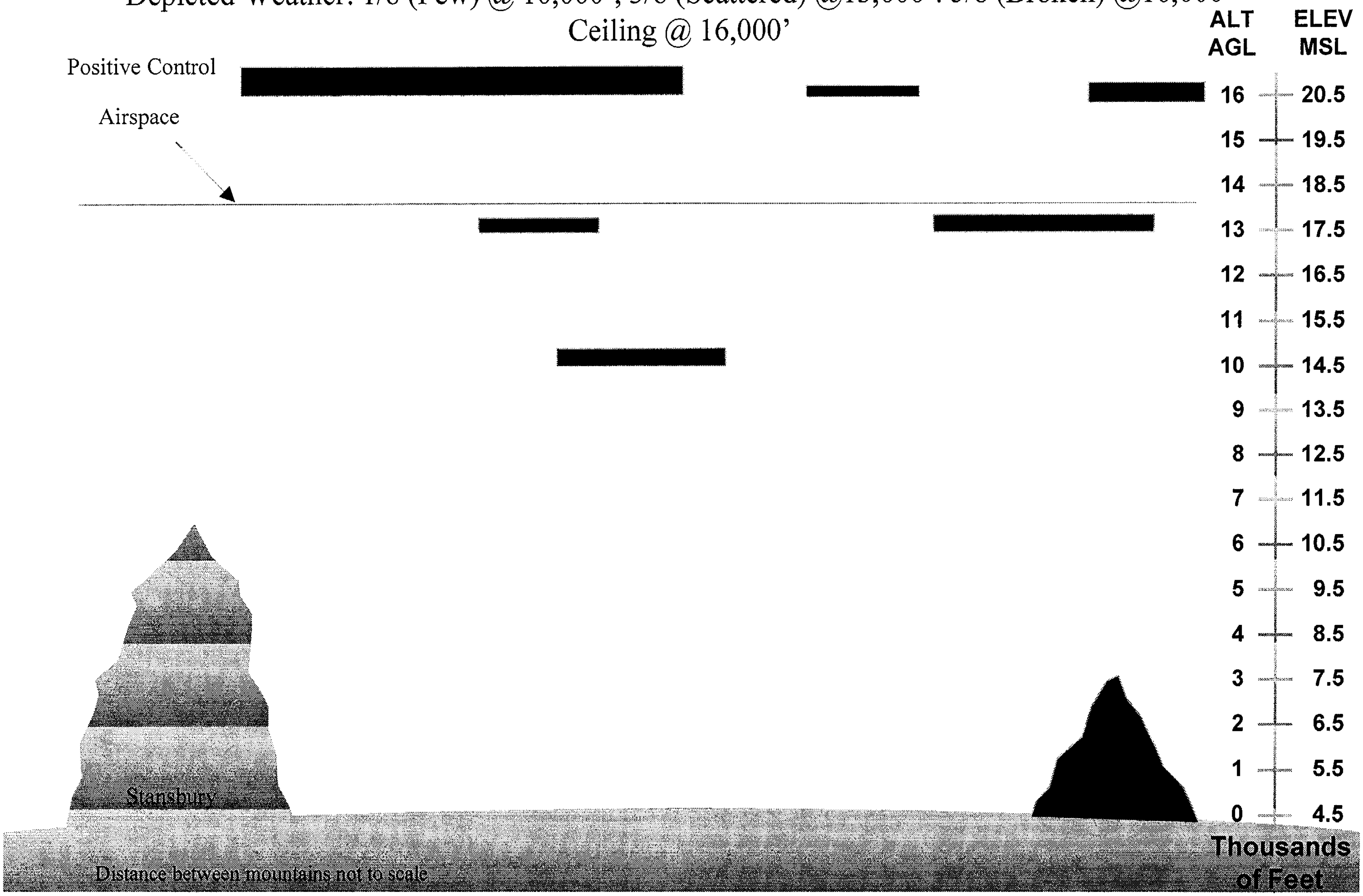


Skull Valley Airspace (Fig. 9-7)

Ceiling > 14,000' & Visibility > 7 Statutes Miles, 74.0% of the time

Depicted Weather: 1/8 (Few) @ 10,000', 3/8 (Scattered) @13,000'. 5/8 (Broken) @16,000'

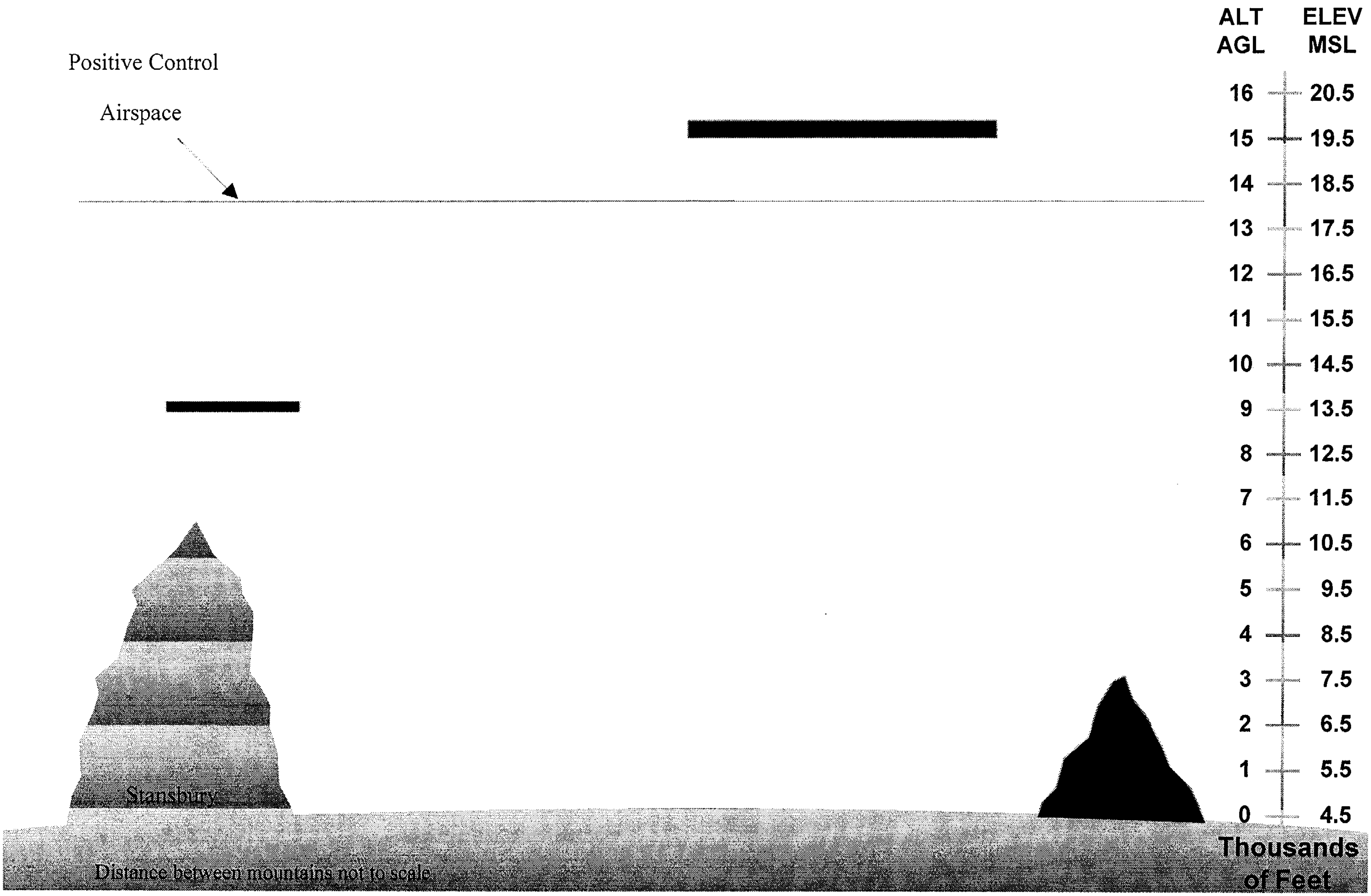
Ceiling @ 16,000'



Skull Valley Airspace (Fig. 9-8)

Ceiling > 14,000’ & Visibility > 7 Statutes Miles, 74.0% of the time

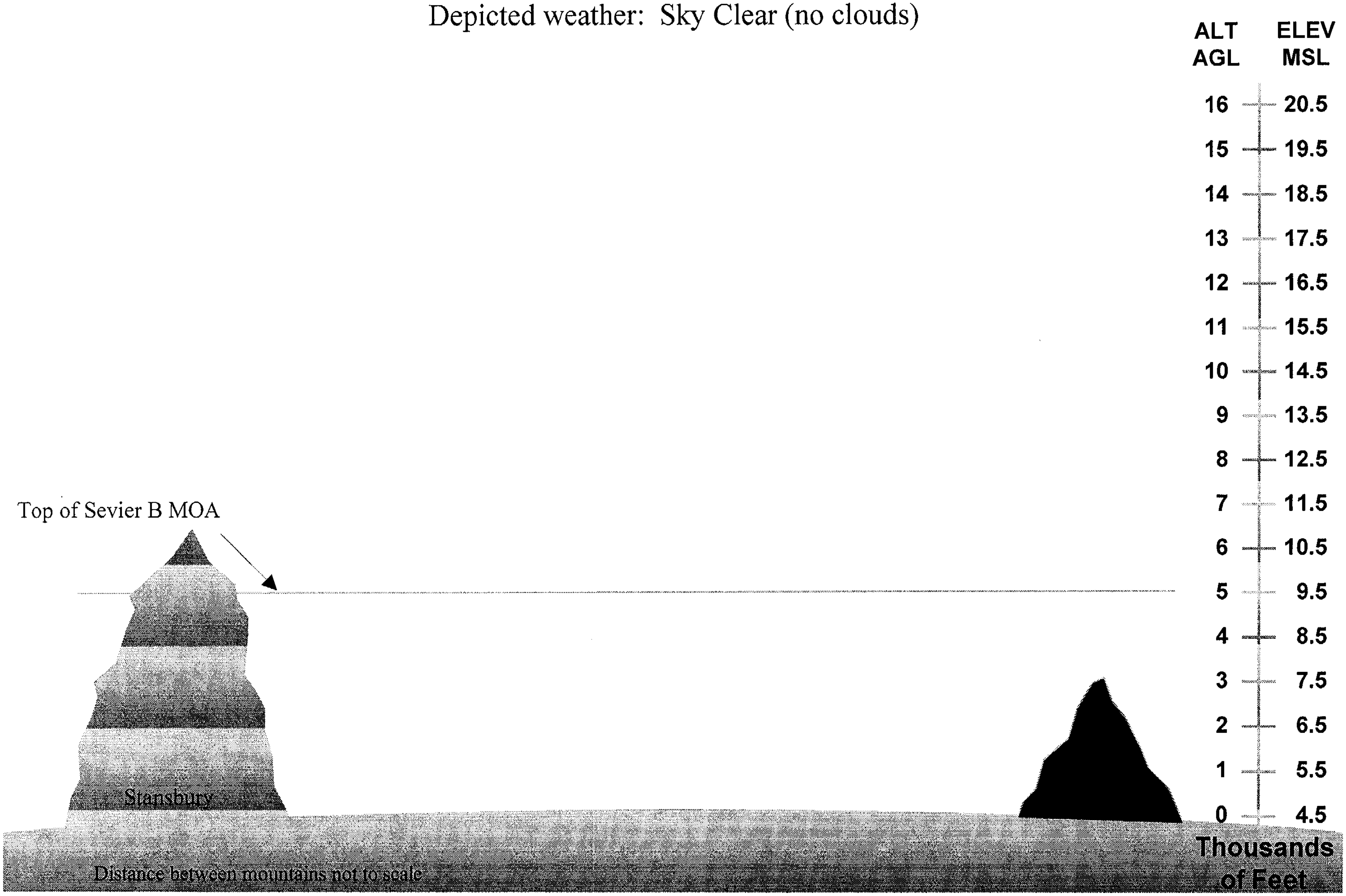
Depicted Weather: 1/8 (Few) @ 9.000’, 2/8 (Few) @ 15,000’; No ceiling



Skull Valley Weather (Fig. 9-9)

Ceiling > 5,000' & Visibility > 7 miles (representative) 91.5% of the time

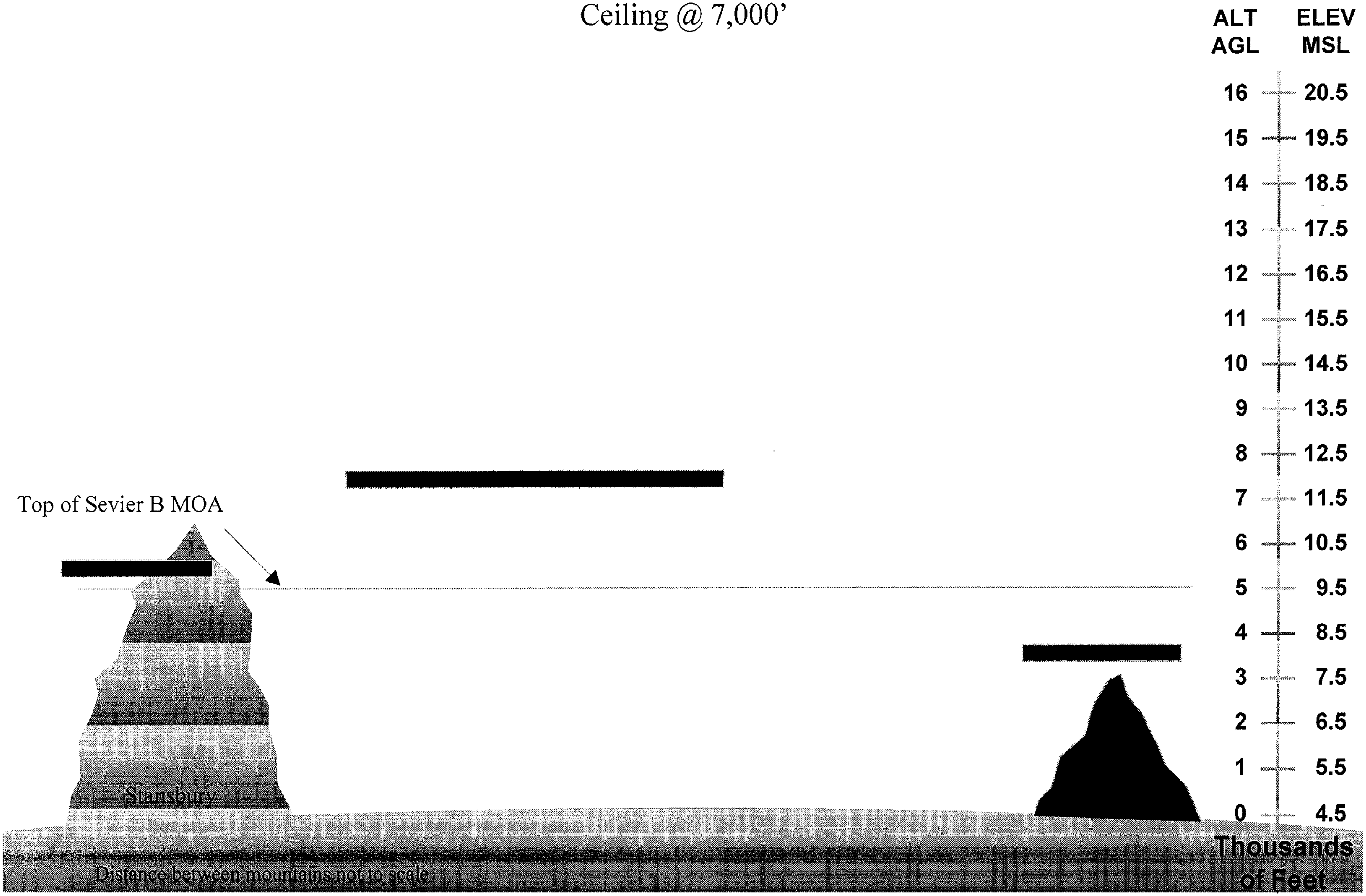
Depicted weather: Sky Clear (no clouds)



Skull Valley Weather (Fig. 9-10)

Ceiling > 5,000' & Visibility > 7 miles (representative) 91.5% of the time

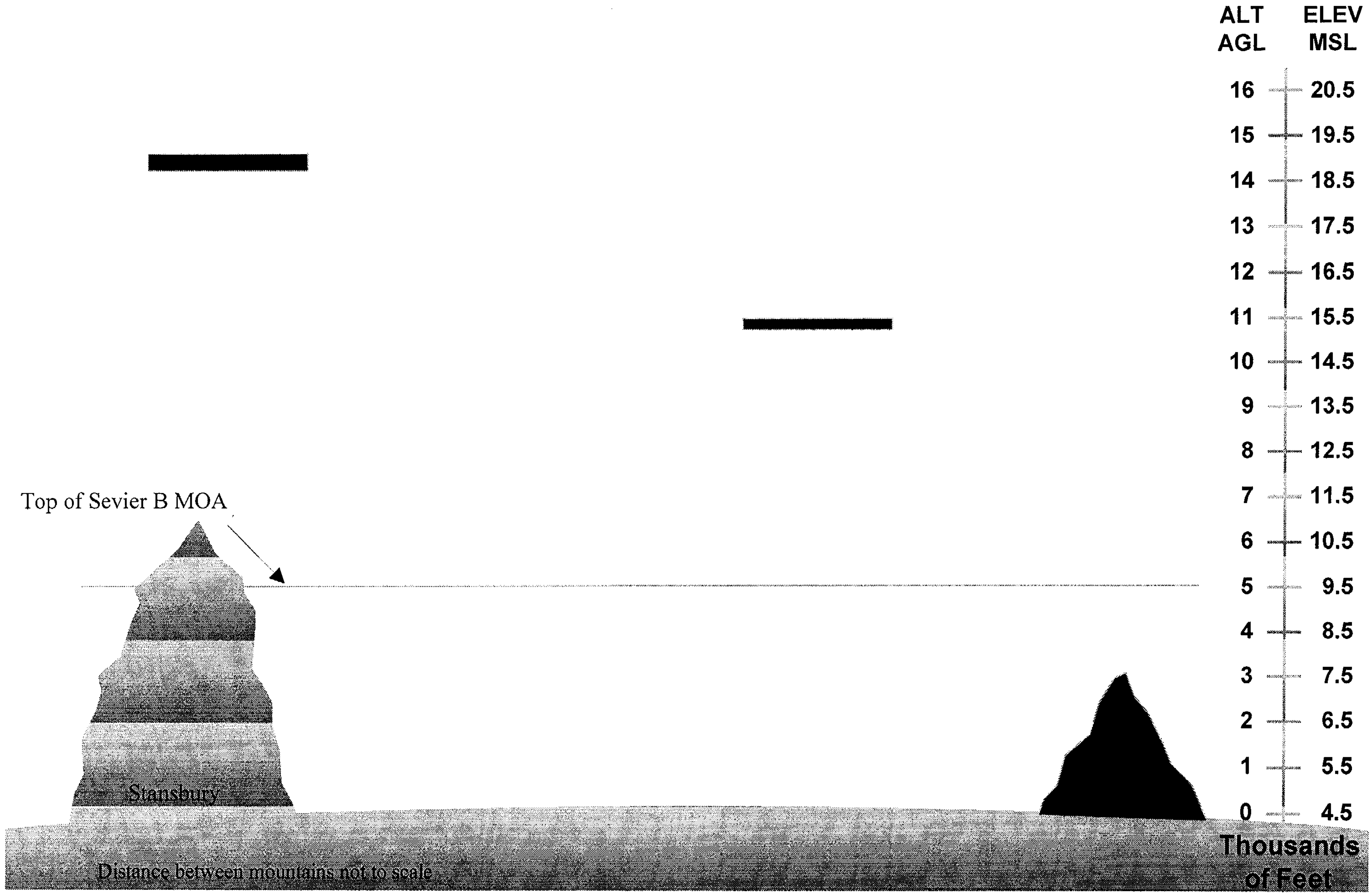
Depicted Weather: 1/8 (Few) @ 3,500', 1/8 (Few) @ 5,500', 3/8 (Scattered) @ 7,000'; Ceiling @ 7,000'



Skull Valley Weather (Fig. 9-11)

Ceiling > 5,000' & Visibility > 7 miles (representative) 91.5% of the time

Depicted weather: 1/8 (Few) @ 11,000', 1/8 (Few) @ 14,000': No ceiling

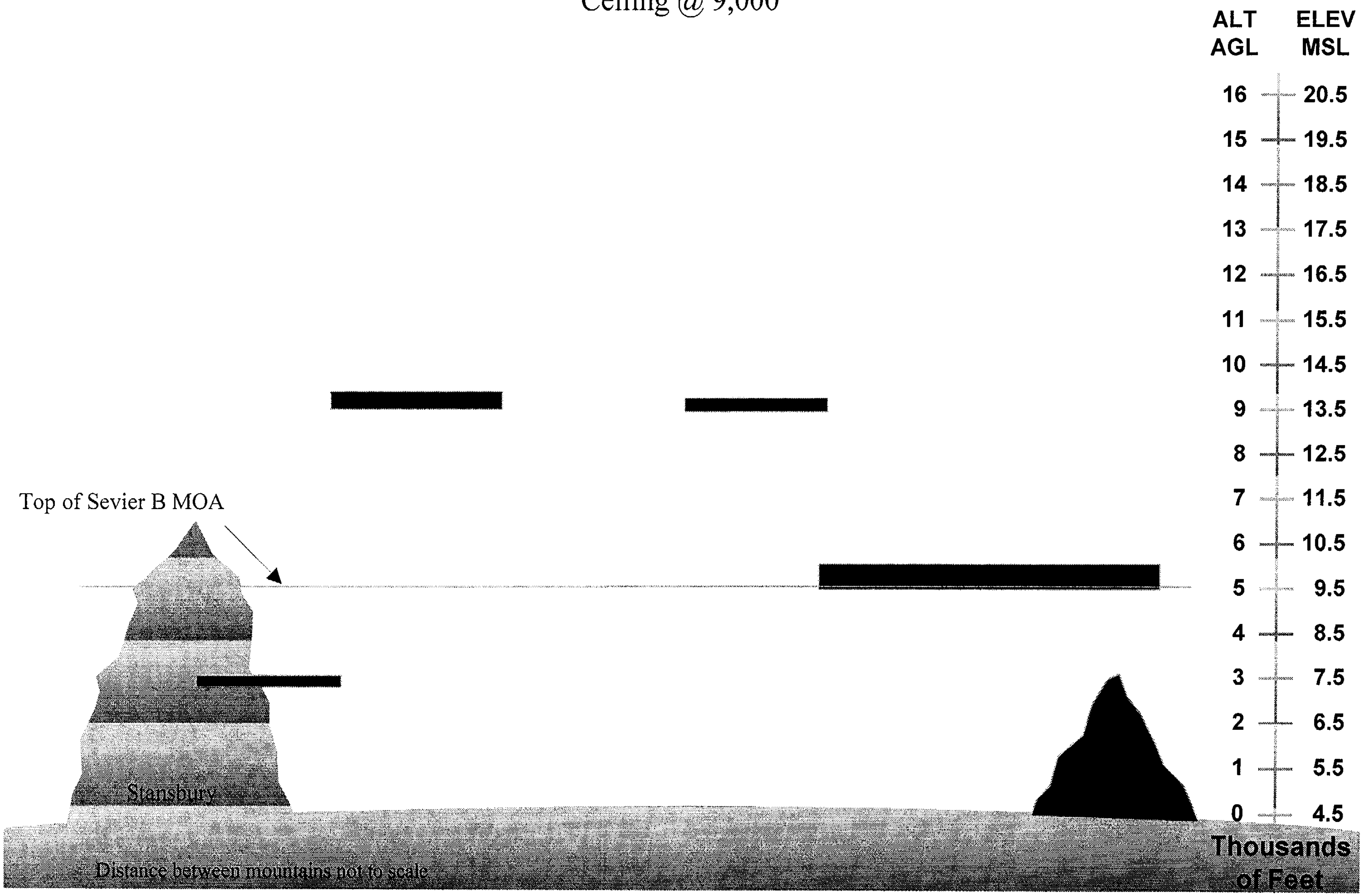


Skull Valley Weather (Fig. 9-12)

Ceiling > 5,000' & Visibility > 7 Statute Miles, 91.5% of the time

Depicted Weather: 1/8 (few) @ 3,000', 2/8 (few) @ 5,000', 2/8 (few) @ 9,000'

Ceiling @ 9,000'



BIRD STRIKES

10. Provide the following items which are related to the effect on the aircraft crash probability at the proposed PFSF from potential bird strikes:

(a) Discuss the extent to which crashes caused by bird strikes were considered in using historical crash data for estimating the F-16 aircraft crash frequency under Skull Valley type conditions.

Response

In analyzing the historical database of F-16 crashes, every accident report received was closely examined. (Report, TAB H). Out of the 121 aircraft crashes, there were 4 crashes (18 Apr 91, 17 Dec 92, 1 Jul 94, 13 May 98) caused by bird strikes. These 4 events were included in the statistics covering losses.

(b) Indicate the bases for exclusion if bird strike induced crashes in the historical crash database were excluded on the basis of non-applicability to Skull Valley. For example, describe specific factors, such as bird size, and flight altitude and frequency, which would form a basis for including or excluding a specific crash in estimating the aircraft crash frequency in Skull Valley.

Response

Of the 4 crashes caused by bird strikes, all 4 occurred during low level flight. Three of the 4 occurred during special in-flight maneuvering, including one in low level navigation training with the bird strike at 300' AGL, one during an air to ground attack training at 1,000 ft. AGL, and one in low level air to air training at 1,000 ft. AGL. All 3 of these accidents were therefore rated as belonging to the Special Inflight category, and therefore not applicable to the Sevier B MOA category of events. All 3 bird strikes resulted in engine failure due to bird ingestion into the engine, and therefore all 3 were considered as engine failure accidents. The pilots all remained in control after the bird strike so all were judged as accidents in which the pilot would have been able to avoid a structure on the ground. Additionally, because they were judged as possible in Skull Valley despite being in the Special Inflight category, they were included in the Skull Valley Type Event calculations.

The 4th bird strike also occurred in low level navigation training, but because it occurred at 830 ft. AGL, it was rated as 'Normal Flight' in accordance with the definitions set forth in TAB H of the Report at page 10, which defined low level flight above 500 ft. as normal flight. The aircraft struck a flock of American White Pelicans while it was on a low level training route near the Missouri River in Nebraska. It was flying in formation with the lead aircraft which was at 500 ft. AGL. The airspeed was 520 knots. With these airspeed and altitude flight parameters, this could have logically been considered as a Special Inflight (increased hazard) category accident, but to be consistent with the previously defined categories and to be conservative, PFS elected to specifically consider it as a normal flight loss and a possible Sevier B MOA or a Skull Valley Type Event accident. The accident resulted from striking at least five of the large pelicans, one or more of which struck and broke the canopy windscreen, causing temporary incapacitation of the pilot and his immediate ejection from the aircraft. It was therefore not rated as an engine failure accident nor as one in which the pilot would be able to avoid a ground structure after the emergency started. This accident is closely detailed in TAB H of the Report, pages 24 and 25.

After very careful consideration, this accident was categorized as not a Sevier B MOA Type Event nor a Skull Valley Type Event for a number of reasons.

1. Most importantly, it involved the collision with a flock of very large water birds near the Missouri River. There is no water in Skull Valley anywhere near the PFSF to attract these birds and they have not been observed in the Valley. According to the Utah State Division of Wildlife Resources, American White Pelicans and several other species of large birds have been observed in the Timpie Springs Wildlife Area, which is 25 miles north of the PFSF and at the edge of the Great Salt Lake north of Interstate 80. The large pelicans are seasonal and dependent on the water level there. They breed on the north side of the Great Salt Lake and are generally in that area. They were observed in the Timpie Springs area in April to May (max count 8) and June/July (max count 2) in 2000. A maximum of 11 (also in May) were seen in 1999, a maximum of 5 in 1998 (in May), but only 2 in 1997. They are dependent on the water level, and in a dry year (lower water level) they will tend to stay away from the Timpie Springs area. Canada Geese are also seen there, predominately during the Fall, a maximum of 37 were seen in Sept 2000, 62 in 1999, 47 in 1998, and 59 in 1997. No white pelicans and only 4 geese (in 1997 and again in 1998) were seen in these years in the Magnesium Corporation bay just west of Stansbury Island.

2. Additionally, bird strikes tend to occur at low altitudes. Air Force bird strike data shows that 70 % of all bird strikes occur at or below 1,000 ft. AGL (95 % occur below 3,000 ft. AGL and 98 % occur below 4,000 ft. AGL). F-16s in Skull Valley are normally at 3,000 ft. to 4,000 ft. AGL. Very few of the reported bird strikes have occurred in this range.

3. A search of the U.S. Air Force Safety Center's Bird Avoidance Model data (http://www.ahas.com/bam) covering all reported bird strikes since 1985 through June 25, 2000 reveals that no bird strikes have occurred in Skull Valley despite the thousands of flights per year through there. The closest bird strike was 25 statute miles from the PFSF on 7 April 1994 on the UTTR (Restricted Area 6406A), when a B-52H bomber struck one bird at 7 PM during low level cruise flight at 600 fee altitude, with no appreciable damage ($726) to the aircraft. Of note, the cross sectional area of a B-52H when viewed from head-on is very large when compared to that of the F-16. Therefore, an F-16 flying the exact same profile would've had much less of a probability of striking that same bird than did the B-52H.

   The next closest bird strike was 37 statute miles away near the north UTTR, on March 2, 1988 when an F-16 struck a bird while flying at 800 feed altitude at 1046 AM during low level cruise flight, with no damage to the aircraft.

   The Bird Avoidance Model (BAM) also shows that of all the bird strikes in the database

(7 strikes in 15 years) within 50 statute miles of the PFSF, none occurred above 800 ft. altitude AGL.

4. The F-16s transiting Skull Valley are normally flying at 350 to 400 knots, so the chances of actually breaking the canopy windscreen are much less even if the aircraft were to strike a large bird. If the bird did not strike the canopy/windscreen but were ingested by the engine, there might be engine problems but the pilot would remain in control and be able to avoid a site on the ground.

5. It could have been eliminated on the grounds that it occurred below the 1,000 ft. AGL threshold minimum altitude for Skull Valley transit, but PFS elected to not consider this factor. (This factor applies to the Sevier B MOA category in Tab H only.)

CRUISE MISSILES

11. Provide the following items which are related to the effect on the potential cruise missile hazard at the proposed PFSF from cruise missile flights in the UTTR:

(a) Specify which cruise missile crashes listed in Table 1 of the cruise missile risk assessment report (letter dated January 25, 2001) occurred outside the UTTR ground or air boundaries.

(b) Describe the planned routes (ground or air) for the cruise missiles that crashed outside the UTTR boundaries and the distance between the crash location and the nearest point to the planned trajectory (i.e., lateral distance).

(c) Clarify whether the cruise missiles crashed within their lateral limits and whether controllers took control and redirected the missiles once a malfunction was realized.

Response

Questions 11(a), (b), and (c) will be answered upon the receipt of responses to PFS Freedom of Information Act (FOIA) requests to the U.S. Air Force.

(d) Discuss whether there is a difference between the tests of stockpile (i.e. operational) cruise missiles and developmental cruise missiles that incorporate some new features or characteristics, as discussed on page 32 of the cruise missile risk assessment report.

Response

The policies, procedures and requirements for test of developmental and stockpile cruise missiles are identical. All must be equipped with an approved Flight Termination Systems (FTS), and tests are conducted with the same scrutiny.

Development Flight Tests are conducted to prove the design of a new missile, or upgrades to missiles in production, while stockpile test are conducted to verify mature system reliability. New designs do not have the mature system reliability, with flight tests conducted to validate the design and grow system reliability. Tests during the development phase tend to be shorter and more restricted in area covered (i.e. more conservative and constrained), with specific test objectives to be accomplished during the test to verify functions and design. These developmental missiles typically have additional telemetry information transmitted during flight to collect the data necessary to validate the design and to diagnose deviations from expected parameters.

Stockpile tests are conducted to verify the "health" of production missiles in inventory and tests typically mirror real-world missions in length and objectives. In both development and stockpile cases, the same procedures and safety precautions are employed, and missiles are kept under positive control of accompanying chase aircraft and range control aircraft to ensure safety.