National Historic Preservation Act (NHPA) Section 106 Assessment of Effects to Historic Properties in New Mexico

Analysis Methodology

Analysis of potential impacts on historic properties is based on the following considerations: (1) physically altering, damaging, or destroying all or part of a resource; (2) altering characteristics of the surrounding environment that contribute to resource significance; (3) introducing visual, audible, or atmospheric elements that are out of character with the property or alter its setting; or (4) neglecting the resource to the extent that it deteriorates or is destroyed.

Impacts to historic properties, including traditional cultural properties, were evaluated for all lands beneath the MOAs, however, the highest potential for impacts would occur on lands beneath those MOAs where the floor would be lowered to support low-level training which includes Tombstone, Outlaw, Jackal, Bagdad, and Gladden MOAs and those MOAs where the supersonic authorization would be lowered to support low-level supersonic training which includes Tombstone, Outlaw, Jackal, Morenci, and Reserve MOAs (see Enclosure 1: Area of Potential Effects [APE]). Proposed changes to the Sells and Ruby/Fuzzy MOAs are administrative and the flight operations in these areas would be the same as what occurs currently. Because the proposed project is an airspace action, only those historic properties that would reasonably be affected by visual and noise intrusions from aircraft operations are considered in this assessment.

Visual and noise intrusions could result from low-level overflights, sonic booms, and the distribution of chaff and flare residual materials. Historic properties potentially affected include National Historic Landmarks or properties listed in, or eligible for listing in, the NRHP that qualify because of setting or feeling, historic architectural resources or archaeological resources with standing structures (such as historic ranches or forts that could be affected by vibrations), national historic trails, and traditional cultural properties that are associated with places that require isolation or quiet. Noise, including infrequent sonic booms and startle effect impacts to traditional cultural properties, may be related to interference with ceremonies and other traditional activities at sacred sites. Impacts to traditional cultural resources and sacred sites can include the introduction of visual, audible, or atmospheric elements to ceremonial life and practices.

Visual Intrusion

Chaff is currently used in all MOAs except for Tombstone MOA. Flares are currently used in all MOAs. The proposed action would not substantially change the use of these materials in any MOA. Chaff and flares deployed from the aircraft would not pose a visual intrusion given the high altitude of flights and the minimum release altitude for chaff and flares (2,000 feet above ground level). Chaff consists of millions of fine fibers (approximately 1 inch long and finer than a human hair) that drift in prevailing wind conditions after release from the aircraft. Flares would only potentially be visible for the few seconds they are burning. The altitude of the flights would make these items virtually undetectable to people on the ground. Small pieces of residual materials (plastic end caps, felt spacers, etc.) are released with chaff and flares and fall to ground as debris. These materials would be widely distributed within the MOAs and would not collect in any one location. These materials would be virtually unnoticeable. Overall, chaff and flares and their associated residual materials are unlikely to affect historic properties.

Visual intrusion of the aircraft itself depends on the distance between the aircraft and the viewer. Visibility is also affected by intervening objects such as landforms, vegetation, or structures that block the viewer from seeing the aircraft, particularly when aircraft are traveling at lower altitudes. Viewer response and interpretation of aircraft overflight varies. Depending upon cultural and instinctual perceptions of danger and sensitivity of the presence of the overflight, visual effects of overflights may have an indirect impact on qualities valued in historic properties where setting is an important factor. The overflight of low flying aircraft at high speed in these areas is more likely to have an impact because of the high visual-quality ratings and level of visual management protection that is more affected by change. The visibility of low-level overflight is temporary and minimal given the small size of the aircraft and visual perception at the altitude of the flight.

Noise Intrusion

Subsonic Noise

Subsonic noise is the noise associated with the aircraft's engine and airframe and is the most common type of noise from aircraft operations. Experimental data and models show that damage to architectural resources, including adobe buildings, is unlikely to be caused by subsonic noise and vibrations from aircraft overflights (Battis 1988, Sutherland 1990, King 1985, King et al. 1988). Subsonic noise-related vibration damage to structures requires high decibel (dB) levels generated at close proximity to the structures and in a low frequency range (USFS 1992, cf. Battis 1983, 1988). Aircraft must generate a maximum sound level of at least 120 dB to potentially result in structural damage (Battis 1988) and, even at 130 dB, structural damage is unlikely. Sutherland (1990) found that the probability of damage to a poorly constructed or poorly maintained wood frame building is less than 0.3 percent even when the building is directly under a large, high-speed aircraft flying only a few hundred feet above ground level.

Supersonic Noise

Sonic booms are associated with supersonic flight and can be associated with structural damage to fragile structures. Overpressure values are used to quantify the intensity of sonic booms and are presented in pounds per square foot (psf). The overpressure varies based on the aircraft maneuver during supersonic speed (climb/descent, turns, acceleration/deceleration) and specific weather conditions (winds, vertical temperature/pressure profile). Most damage claims from sonic booms are for brittle objects, such as glass and plaster. There is a large degree of variability in damage and depends on the pre-existing condition of a structure. Typical outdoor structures such as buildings, windmills, radio towers, etc., are resilient and routinely subject to wind loads far in excess of sonic boom overpressures. Damage to plaster occurs at similar ranges to glass damage. The potential for damage to plaster from sonic booms may be compounded by other issues such as cracking that results from shrinkage or structural settling. Some degree of damage to glass and plaster is possible during high intensity sonic booms, but the frequency of such events is low. **Table 1** provides general descriptions of the type of damages from various overpressure values.

Some prehistoric archaeological sites could contain natural structures such as rock shelters or caves. These structures often house petroglyphs or pictographs, which are etched or painted onto the rock surfaces. However, studies have found that these types of formations are not affected by noise vibrations, such as sonic booms, any more than by natural erosion, wind, or seismic activity (Battis 1983). A more recent study analyzed sonic boom effects at four selected petroglyph/pictograph sites on Nellis Air Force Range and adjacent overflight lands (White and Orndorff 1999). Visual observation of the physical properties at each of these sites determined that the rock panel degradation was consistent with natural weathering and chemical alteration processes rather than sonic booms (White and Orndorff 1999).

Table 1 Potential Damage from Sonic Boom Overpressures

Sonic Boom Overpressure Nominal (psf)	Structural Element	Potential Type of Damage and Item(s) Affected
0.5–2 psf	Glass	Extension of existing crack; potential for failure for glass panes in bad repair; failure potential for existing good glass panes is less than 1 out of 10,000 at 2 psf.
	Ceiling Plaster	Fine cracks; extension of existing cracks; mostly from fragile areas.
	Wall Plaster	Fine cracks; extension of existing cracks less than in ceilings; over door frames; between some plasterboards; mostly from fragile areas.
	Roof	Older roofs may have slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole; new and modern roofs are rarely affected.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.
2–4 psf	Glass	Glass pane failures may occur that are difficult to forecast in terms of the glass panes' existing localized condition. Nominally in good condition.
	Ceiling Plaster	Estimated rate of cracking ranges from less than 1 out of 5,000 (2 psf) to 1 out of 625 (4 psf).
	Wall Plaster	Estimated rate of cracking ranges from less than 1 out of 10,000 (2 psf) to 1 out of 1,000 (4 psf).
	Roof	Potential for nail peg failure if eroded.
	Bric-a-brac	Increased risk of tipping or falling objects.
4–10 psf	Glass	Estimated rate of failure of well-installed glass ranges from 1 out of 50 (10 psf) to 1 out of 500 (4 psf); failure potential industrial and greenhouse glass panes.
	Ceiling Plaster	Estimate rate of cracking ranges from 1 out of 526 (4 psf) to 1 out of 10 (10 psf). Potential for partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Wall Plaster	Estimated rate of cracking ranges from less than 1 out of 1,000 (4 psf) to 1 out of 50 (10 psf). Measurable movement of inside "party" walls at 10 psf.
	Roof	Regular failures within a large population of nominally good slate, slurry wash; some change of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Bric-a-brac	Increased risk of tipping of falling objects.
>10 psf	Glass	Some good glass will fail regularly (greater than 1 out of 10) to sonic booms and at an increased rate when the wavefront is normal to the glass pane. Glass with existing faults could shatter and fly. Large window frames could move.
	Ceiling Plaster	Plasterboards may be displaced by nail popping.
	Wall Plaster	Most plaster affected. Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; rarely domestic chimneys dislodged if not in good condition.
	Bric-a-brac	Some nominally secure items can fall, e.g., large pictures, especially if fixed to "party" walls.

Legend: > = greater than; psf = pounds per square foot.
Source: Haber and Nakaki 1989.

Assessment of Effects

The special use airspace being addressed in the EIS includes DAF managed MOAs and their associated high altitude ATCAAs named Tombstone, Outlaw, Jackal, Morenci, Reserve, Bagdad, Gladden, Sells, Ruby/Fuzzy located throughout Arizona and a small area of western New Mexico (Enclosure 1). The Draft EIS addresses four alternatives: No Action (Alternative 1), the Proposed Action (Alternative 2), and two variations of the Proposed Action Alternatives 3 and 4. Each is briefly described in the sections below. Please refer to the complete Draft EIS on the project website: www.ArizonaRegionalAirspaceEIS.com.

Alternative 1 – No Action

Under the No Action Alternative, all the MOAs/ATCAAs would continue to be used for flight operations as they are currently. None of the proposed modifications to the airspace structure would occur. Overflights would continue to be a visual and/or noise intrusion due to low-altitude flights in some areas. The annual average subsonic noise environment under the No Action Alternative within the MOAs is relatively low; none of the MOAs/ATCAAs exceed 65 dB Day-Night Average Sound Level (DNL). 65 dB DNL is a level defined by the Federal Interagency Committee on Urban Noise (FICUN) considered generally compatible with all land uses to include residential, public use, or recreational and entertainment areas. The annual average supersonic noise environment is also low, with none of the MOAs/ATCAAs exceeding 62 C-weighted dB DNL (CDNL). The U.S. Army Public Health Command indicates that 62 dBC CDNL is the level considered generally compatible with all land uses, similar to 65 dB DNL.

Individual low-level overflights in the Jackal Low and Fuzzy MOA could have a peak sound level as high as 131 dB depending on the type of aircraft (flights are authorized down to 100 feet above ground level (AGL) in these MOAs), but the peak sound only lasts for a fraction of a second. Individual low-level overflights in the Tombstone MOA could have a peak sound level as high as 121 dB (parts of the Tombstone MOA are currently authorized to 500 feet AGL). The individual overflights in the remaining MOAs (Jackal, Outlaw, Morenci, Reserve, Bagdad, Gladden, and Sells MOAs) would be at a higher altitude with a lower peak sound level. Conservatively, only sounds lasting more than 1 second above a sound level of 130 dB are potentially damaging to structural components (Committee on Hearing, Bioacoustics, and Biomechanics 1977). Peak sound levels would not exceed this value for more than 1 second under the No Action Alternative. Thus, breakage is not anticipated from subsonic overflights.

A specific, single location may or may not experience a sonic boom. Sonic booms of varying intensity could occur beneath the airspace authorized for supersonic flight which includes all MOAs/ATCAAs except for Ruby/Fuzzy MOA/ATCAA. Tombstone, Outlaw, Jackal, Morenci, and Reserve MOAs/ATCAAs all have a minimum altitude for supersonic operation of 30,000 feet mean sea level (MSL). Sonic boom intensity at this altitude could be as high as 1.8 psf depending on the type of aircraft and the speed. Within Bagdad, Gladden, and Sells MOAs, the minimum altitude for supersonic flight is 10,000 feet MSL resulting in higher psf values of up to 5.3 depending on the type of aircraft and speed.

The types of structures most susceptible to sonic booms are glass and adobe or similar plaster-type materials. Historic standing structures on the lands beneath the affected airspace consist primarily of wood or log buildings with window glass and some adobe or earth block structures. The infrequency and the random nature of the sonic booms suggest that structural damage to historic structures would be unlikely.

Given the current use of the airspace there would be no adverse effects in accordance with 36 CFR 800.5(b) to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites under the No Action Alternative.

Alternative 2 – Proposed Action

Under Alternative 2, the DAF has proposed changes to horizontal dimensions (Tombstone MOA only), vertical dimensions, and the authorized supersonic altitude in the MOAs/ATCAAs to address the training shortfalls caused by the insufficient existing special use airspace. The structural changes to the airspace include:

- Expanding the northern boundary of the Tombstone MOA/ATCAA approximately 10 nautical miles (Tombstone A, B, and C on Enclosure 1 constitutes the existing MOA) and lowering the floor of this MOA to 100 feet above ground level (AGL) (currently the floor is 500 feet AGL). This is the only MOA with proposed horizontal changes.
- Lowering the floors of Outlaw, Jackal, Bagdad, and Gladden MOAs to 500 feet AGL to allow for additional low-altitude training in the region. The floors of the Outlaw and Jackal MOAs are currently 3,000 feet AGL and the floors of the Bagdad and Gladden MOAs are currently 5,000 feet AGL.
- Authorizing supersonic flight down to 5,000 feet AGL in Tombstone, Outlaw, Jackal, Morenci, and Reserve MOAs/ATCAAs.
- Lowering the minimum release altitude of flares to the standard minimum 2,000 feet AGL. Flares are currently used in all MOAs/ATCAAs. Flares are designed to burn out completely within 3 to 5 seconds, during which time the flare would fall between 200 to 400 feet. The use of flares in all MOAs/ATCAAs is restricted based on local fire conditions as a best management practice.
- Authorizing the use of chaff in the Tombstone MOA/ATCAA (chaff is currently used in all other MOAs)

The EIS also addresses an administrative change to the published times of use in the aeronautical charts for all 10 MOAs. The MOAs are routinely used outside of the current published times of use through notice to air missions (NOTAMs). The proposed changes to the published times would better align with how the MOAs are currently used and eliminate the administrative burden of issuing NOTAMs on a recurring basis. Adjusting the published times of use would not change the percentage of operations that occur during the nighttime; nighttime operations outside of the published times currently occurs through the NOTAM process. Changing the published times of use would be the only modification to the Sells and Ruby/Fuzzy MOAs/ATCAAs.

When compared to the No Action Alternative, Alternative 2 would not result in significant changes to the DNL (subsonic noise) or CDNL (supersonic noise) in any of the MOAs. None of the predicted DNL values exceed 65 dB DNL, indicating the noise exposure is compatible with all land uses. Likewise, none of the predicted CDNL values exceed 62 CDNL, indicating the exposure is compatible with all land uses. While not a significant increase, the areas with the largest subsonic noise change would be Jackal, Jackal Low, Outlaw, Gladden, and Bagdad MOAs, and parts of the Tombstone MOA. These are the MOAs that have the greatest adjustment to altitudes of flight training, thus an increase in noise exposure would be expected.

Individual low-level overflights in the Jackal Low and Fuzzy MOA could have a peak sound level as high as 131 dB (which is the same as the No Action), however, under the Proposed Action low-level overflights in the Tombstone MOA could also reach these peak levels depending on the type of aircraft. The peak sound only lasts for a fraction of a second. Individual low-level overflights in the Jackal, Outlaw, Bagdad and Gladden MOAs could have a peak sound level as high as 121 dB since flights would be authorized to 500 feet AGL under Alternative 2. Even in the MOAs where no special flight restrictions apply, experiencing noise from an aircraft that is directly overhead at 100 or 500 feet would be relatively rare. A number of factors limit flights at this altitude to include Federal Aviation Administration prescribed minimum safe altitudes over cities, towns, or settlements. Time spent at the lowest altitude is limited to only what is needed to accomplish training requirements. The MOAs in the region are very large and operations occur throughout the entire volume of the MOA, thus any location on the ground would be overflown at low altitude infrequently. The percent chance of experiencing a flight at 100 or 500 feet AGL in the MOAs with newly proposed lower floors (Tombstone, Outlaw, Jackal, Bagdad, and Gladden MOAs) would range from less than 1 to 7 percent in any given week depending on the MOA. As described above, only sounds lasting more than 1 second above a sound level of 130 dB are potentially damaging to structural components (Committee on Hearing, Bioacoustics, and Biomechanics 1977). Peak sound levels would not exceed this value for more than 1 second under Alternative 2. Thus, breakage is not anticipated from subsonic overflights.

Supersonic flight authorizations would be unchanged in the Bagdad, Gladden, Sells, and Ruby/Fuzzy MOAs under Alternative 2. Supersonic flight would be authorized at a minimum of 5,000 feet AGL in Tombstone, Outlaw, Jackal, Morenci, and Reserve MOAs. Supersonic overflight at the proposed low altitude would result in sonic booms with higher intensity than the No Action. At the proposed minimum altitude (5,000 feet AGL), overpressures could range up to 9.4 psf depending on the type of aircraft and speed. This would represent an increase in intensity over the No Action Alternative. However, due to the many variables involved in the training activities, it is impossible to predict when and where sonic booms may occur. The types of structures most susceptible to sonic boom overpressures are glass and adobe or similar plaster-type materials (see **Table 1**). Historic standing structures on the land beneath the affected airspace consist primarily of wood or log buildings with window glass and some adobe or earth block structures. The maximum predicted psf for sonic booms associated with the undertaking would be less than 10, which does have the potential to result in glass breakage and cracks in plaster in some fragile structures. While a single sonic boom may have a high intensity and the potential for some damage, the infrequency and random nature of these booms suggest that structural damage to historic structures would be unlikely.

Therefore, based on the impact discussion above there would be no adverse effects in accordance with 36 CFR § 800.5(b) to NRHP-eligible or -listed archaeological resources or architectural resources under Alternative 2.

<u>Alternative 3</u>

Alternative 3 would alleviate training shortfalls and address evolving training needs of DAF aircrews by implementing the same proposed modifications as Alternative 2, except the northern expansion of approximately 10 nautical miles of Tombstone MOA/ATCAA would not occur. Tombstone A, B, and C would be combined, and the floor lowered to 100 feet. To increase the volume of airspace available to support Davis-Monthan AFB training needs down to 100 feet AGL, the floor of Jackal MOA would also be lowered to 100 feet AGL, consuming the existing Jackal Low MOA. This alternative also includes authorizing supersonic flight down to 5,000 feet in Tombstone, Outlaw, Jackal, Gladden, and Bagdad MOAs, allowing for the use of chaff in Tombstone MOA, and lowering the minimum release altitude for flares to 2,000 feet AGL (same as Alternative 2).

Similar to Alternative 2, Alternative 3 would not result in significant changes to the DNL (subsonic noise) or CDNL (supersonic noise) in any of the MOAs. None of the predicted DNL values exceed 65 dB DNL, indicating the noise exposure is compatible with all land uses. Likewise, none of the predicted CDNL values exceed 62 CDNL, indicating the exposure is compatible with all land uses. The potential impacts from noise and the peak noise level of low-level overflights would be the same as described above, but under Alternative 3, overflights at 100 feet AGL would be possible in the Tombstone and Jackal MOAs (which could have a peak sound level as high as 131 dB).

As with Alternative 2, the minimum altitude for supersonic flight in Tombstone, Jackal, Outlaw, Morenci, and Reserve MOAs would be reduced to 5,000 feet AGL. The potential structural impacts from sonic booms would be the same as described above under Alternative 2. Therefore, there would be no adverse effect in accordance with 36 CFR § 800.5(b) to NRHP-eligible or -listed archaeological resources or architectural resources under Alternative 3.

Alternative 4

Alternative 4 would alleviate training shortfalls and address evolving training needs of DAF aircrews by implementing the same proposed modifications as described for Alternative 2, except that supersonic flight would be authorized down to 10,000 feet AGL (instead of 5,000 feet AGL) in Tombstone, Outlaw, Jackal, Morenci, and Reserve MOAs. Under Alternative 4, the potential impacts from subsonic noise exposure and single events would be the same as described above under Alternative 2.

Under Alternative 4, the minimum altitude for supersonic flight in Tombstone, Jackal, Outlaw, Morenci, and Reserve MOAs would be reduced to 10,000 feet AGL. At the proposed minimum altitude (10,000 feet AGL), overpressures could range up to 5.3 psf depending on the type of aircraft and speed. This would result in increased overpressures from sonic booms when compared to the No Action, but at a lesser degree than those described under Alternative 2. The potential damage from sonic booms would be similar to those described for Alternative 2 and glass breakage and plaster cracks would be possible. The infrequent occurrence of sonic booms and random nature suggest that structural damage would be unlikely. Therefore, there would be no adverse effect in accordance with 36 CFR 800.5(b) to NRHP-eligible or -listed archaeological resources or architectural resources under Alternative 4.

Conclusion

There would be no adverse effect in accordance with 36 CFR § 800.5(b) to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites under the No Action Alternative (Alternative 1).

Under Alternatives 2, 3, and 4 supersonic overflights at the proposed low altitude would result in sonic booms. Due to the many variables involved in the training activities within the MOAs/ATCAAs, it is impossible to predict when and where sonic booms may occur. The maximum predicted psf for sonic booms associated with the undertaking under any of the action alternatives would be less than 10, which does have the potential to result in glass breakage and cracks in plaster. However, the infrequency and random nature of sonic booms suggest that structural damage to historic structures would be unlikely.

Therefore, there would be no historic properties (NRHP-eligible or -listed archaeological resources or architectural resources) affected under Alternatives 2, 3, and 4 in accordance with 36 CFR § 800.4(d)(1).

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Enclosure 1 – Area of Potential Effects (APE)