Appendix G
Biological Resources – Supplemental Information

APPENDIX G BIOLOGICAL RESOURCES – SUPPLEMENTAL INFORMATION

1.0 Definition of Resource and Region of Influence (ROI)

Holloman Air Force Base. Biological resources consist of native or naturalized plants and animals, along with their habitats, including wetlands. Although the existence and preservation of biological resources are both intrinsically valuable, these resources also provide essential aesthetic, recreational, and socioeconomic benefits to society. This section focuses on plant and animal species and vegetation types that are important to the functioning of local ecosystems, are of special societal importance, or are protected under federal or state law or statute. The ROI for this resource is Holloman AFB.

Area Under Airspace. As treated in Section 4.6, biological resources include vegetation and habitat, wetlands, fish and wildlife, and special-status species (on lands under training airspace). Section 3.6.1 explains these resources in more detail. In addition, because of concerns expressed during scoping, domestic animals are included in the discussion of environmental consequences to biological resources. The ROI encompasses all lands under the proposed F-22A training airspace in southern New Mexico. The ROI spans several landownership classifications; Bureau of Land Management (BLM), U.S. Forest Service, Department of Defense, National Park Service, U.S. Fish and Wildlife Service (USFWS), and tribal, state and private lands all occur under the proposed F-22A training airspace.

2.0 Regulatory Setting

National Environmental Policy Act (NEPA)

NEPA requires federal agencies to take into consideration the potential environmental consequences of proposed actions in their decision-making process. The intent of NEPA is to protect, restore, and enhance the environment through well-informed federal decisions. The CEQ was established under NEPA to implement and oversee federal policy in this process. The CEQ subsequently issued the Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR Sections 1500–1508) . These requirements specify that an EA be prepared to:

- Briefly provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a FONSI;
- Aid in an agency's compliance with NEPA when an EIS is not necessary; and
- Facilitate preparation of an EIS when one is necessary.

The activities addressed within this document constitute a federal action and therefore must be assessed in accordance with NEPA. To comply with NEPA, as well as other pertinent environmental requirements, the decision-making process for the Proposed Action includes the development of this EA to address the environmental issues related to the proposed activities. The Air Force implementing procedures for NEPA are contained in 32 CFR Part 989 *et seq.*, *Environmental Impact Analysis Process.*

Endangered Species Act

The Endangered Species Act (ESA) of 1973 (16 USC §§ 1531–1544, as amended) established measures for the protection of plant and animal species that are federally listed as threatened and endangered, and for the conservation of habitats that are critical to the continued existence of those species. Federal agencies must evaluate the effects of their proposed actions through a set of defined procedures, which can include the preparation of a Biological Assessment and can require formal consultation with the United States Fish and Wildlife Service (USFWS) under Section 7 of the Act.

Implementation of an alternative will involve coordination with several organizations and agencies. Compliance with the ESA requires communication with the USFWS in cases where a federal action could affect listed threatened or endangered species, species proposed for listing, or candidates for listing. The primary focus of this consultation is to request a determination of whether any of these species occur in the region of influence. If any of these species are present, a determination of the potentially adverse effects on the species is made. Should no species protected by the ESA be affected by the Proposed Action, no additional action is required. No adverse effects are anticipated. Letters were sent to the appropriate USFWS offices as well as state agencies, informing them of the Proposed Action and alternatives and requesting data regarding applicable protected species. Appendix A includes copies of relevant coordination letters sent by the Air Force.

Clean Water Act (CWA)

The Clean Water Act (CWA) of 1977 (33 USC § 1251 *et seq*.) and the EPA Storm Water General Permit regulate pollutant discharges that could affect aquatic life forms or human health and safety. Section 404 of the CWA and EO 11990, *Protection of Wetlands*, regulate development activities in or near streams or wetlands. Section 404 regulates development in streams and wetlands and requires a permit from the United States Army Corps of Engineers (USACE) for dredging and filling in wetlands. EO 11988, *Floodplain Management*, requires federal agencies to take action to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Federal agencies are directed to consider the proximity of their actions to or within floodplains. There are no wetlands in any of the proposed construction areas at Holloman Air Force Base.

Migratory Bird Treaty Act (16 U.S.C. 703 et seq.) and Executive Order 13186

The Migratory Bird Treaty Act (MBTA) governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests. The take of all migratory birds is governed by the MBTA's regulation of taking migratory birds for educational, scientific, and recreational purposes and requiring harvest to be limited to levels that prevent overuse. The MBTA also prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase or barter, any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit (50 CFR 21.11).

Many birds in the region are protected by the Migratory Bird Treaty Act (MBTA). Under the MBTA the intentional taking of these species requires a depredation permit. However, if a migratory bird species is involved in a bird-aircraft strike it would be considered an incidental taking not an intentional taking. Such incidental taking during military training is exempt from any permitting requirement by Section 315 of the FY 03 National Defense Authorization Act, signed 2 December 2003, which authorized the USFWS (Service) to allow DoD (Military Services) unintentional take of migratory birds during military readiness activities. The Service in cooperation with the Military Services is developing implementing regulations related to the migratory bird exemption.

Executive Order (EO) 13186 (effective January 10, 2001), outlines the responsibilities of Federal agencies to protect migratory birds, in accordance with the MBTA, the Bald and Golden Eagle Protection Acts, the Fish and Wildlife Coordination Act, ESA, and NEPA. This order specifies the following:

- The USFWS as the lead for coordinating and implementing EO 13186;
- Requires Federal agencies to incorporate migratory bird protection measures into their activities; and
- Requires Federal agencies to obtain permits from USFWS before any "take" occurs, even when the agency intent is not to kill or injure migratory birds.
- EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (2001) recognizes the ecological and economic importance of migratory birds to this and other countries requires federal agencies to evaluate the effects of their actions and plans on migratory birds (with an emphasis on species of concern) in their NEPA documents. Listing among the federal Birds of Conservation Concern confers no legal protection independent of protection that is afforded under the Migratory Bird Treaty Act or other legislation.

3.0 Additional Data

Categories of endangered, threatened, and sensitive species used in this document.

Federally Listed Threatened and Endangered Species. The ESA of 1973 provides protection to species federally listed as endangered or threatened. Endangered species are those species that are at risk of extinction in all or a significant portion of their range. Threatened species are those that could be listed as endangered in the near future.

State Listed Wildlife and Plants. The State of New Mexico maintains its own list of state endangered, threatened, and sensitive wildlife species.

Other Sensitive Species. Taxa under this heading receive no legal protection under the ESA. They include federally proposed endangered species, proposed threatened species, and species of concern. Federally proposed endangered and threatened species are those proposed to be listed as endangered and threatened under the ESA, respectively (formal ruling in progress). Federal species of concern (formerly labeled as candidate species) are those for which the USFWS has on file sufficient information on biological vulnerability and threats to support proposals to list them as endangered or threatened, but issuance of proposed rules for these species is precluded by higher priority listing actions.

Other sensitive species at the federal level also include birds of conservation concern, defined as those migratory, nongame avian species in greatest need of conservation action at different geographic scales.

Other sensitive species also include those identified by the New Mexico Natural Heritage Program as species critically imperiled globally or at the state level, irrespective of whether they are listed under any of the federal designations described above.

Many of the species listed in Table 1 are habitat specific, meaning that they are almost exclusively found in their associated habitats and tend not to stray from their associated landscapes. In addition, some species in Table 1 are seasonal or accidental occurrences that have been documented on the Holloman AFB in the past.

4.0 Review of effects of aircraft noise, chaff, and flares on biological resources

4.1 *Introduction*

This biological resources appendix addresses the effects of aircraft noise, including sonic booms, on wildlife and domestic animals. This appendix also considers the effects of training chaff and flares on biological resources under the training airspaces currently used by Holloman Air Force Base and the proposed use by F-22A.

4.2 *Aircraft Noise*

The review of the noise effects literature shows that the documented reaction of animals newly or infrequently exposed to low-altitude aircraft and sonic booms ranges from no reaction to an alert posture or a "startle effect." Although an observer's interpretation of the startle effect is behavioral (e.g., the animal runs in response to the sound or flinches and remains in place), it does have a physiological basis. The startle effect is a reflex; it is an autonomic reaction to loud, sudden noise (Westman and Walters 1981, Harrington and Veitch 1991). Increased heart rate and muscle flexion are the typical physiological responses.

The literature indicates that the type of noise that can stimulate the startle reflex is highly varied among animal species (Manci *et al.* 1988). In general, studies have indicated that close, loud, and sudden noises that are combined with a visual stimulus produce the most intense reactions. Rotary wing aircraft (helicopters) generally induce the startle effect more frequently than fixed wing aircraft (Gladwin *et al.* 1988, Ward *et al.* 1999). Similarly, the clap of a nearby sonic boom has a higher potential to startle an animal compared to the thunder-like sound from a distant sonic boom. External physical variables, such as landscape structure and wind, can also lessen the animal's perception of and response to aircraft noise (Ward *et al.* 1999).

Animals can habituate to fixed wing aircraft noise as demonstrated under controlled conditions (e.g., Conomy *et al.* 1998, Krausman *et al.* 1998) and by observations reported by biologists working in parks and wildlife refuges (Gladwin *et al.* 1988). Brown *et al.* (1999) defined habituation as "… an active learning process that permits individuals to discard a response to a recurring stimulus for which constant response is biologically inappropriate without impairment of their ability to respond to other stimuli." However, species can differ in their ability to habituate to aircraft noise, particularly the sporadic noise associated with military aircraft training (e.g., Conomy *et al.* 1998).

Table 1. Threatened, Endangered, and Sensitive Species on or in the Vicinity of Holloman AFB (Page 1 of 3)

Common Name	*Scientific Name*	*Status*[1]	*Potential for occurrence*
Mammals			
Western small-footed myotis bat	*Myotis ciliolabrum melanorhinus*	SS, FSC	Present on Holloman Air Force Base (AFB); very unlikely to occur in combined project construction area based on habitat associations
Spotted bat	*Euderma maculatum*	ST, FSC	Present on Holloman AFB; very unlikely to occur in project construction area based on habitat associations
Townsend's big-eared bat	*Plecotus townsendii*	SS, FSC	Present on Holloman AFB; very unlikely to occur in project construction area based on habitat associations
Big free-tailed bat	*Nyctinomops macrotis*	SS, FSC	Possibly present on Holloman AFB; very unlikely to occur in project construction area based on habitat associations
Rock squirrel	*Spermophilus □ariegates tularosae*	SS	Present on Holloman AFB
Black-tailed prairie dog	*Cynomys ludovicianus*	SS	Unlikely to be present on Holloman AFB; not recorded in project construction area
Botta's pocket gopher	*Thomomys bottae tularosae*	SS	Possibly present on Holloman AFB
Desert pocket gopher	*Geomys arenarius*	SS, FSC	Possibly present on Holloman AFB
Plains pocket mouse	*Perognathus flavescens gypsi*	SS	Present on Holloman AFB
Ringtail	*Bassariscus astutus*	SS	Present on Holloman AFB
Western spotted skunk	*Spilogale gracilis*	SS	Possibly present on Holloman AFB
Common hog-nosed skunk	*Conepatus mesoleucus*	SS	Possibly present on Holloman AFB
Birds			
Brown pelican	*Pelecanus occidentalis*	SE, FE	Accidental occurrence on Holloman AFB (only one record)
Neotropic cormorant	*Phalacrocorax brasilianus*	ST	Present on Holloman AFB
White-faced ibis	*Plegadis chihi*	SS	Present on Holloman AFB
Northern harrier	*Circus cyaneus*	FBCC	Present on Holloman AFB
Northern gray hawk	*Asturina nitida maximus*	SS, FSC	Present on Holloman AFB

Table 1. Threatened and Endangered Species on or in the Vicinity of Holloman AFB (Page 2 of 3)

Common Name	*Scientific Name*	*Status*[1]	*Potential for occurrence*
Ferruginous hawk	*Buteo regalis*	FSC, FBCC	Documented only once on Holloman AFB, in gypgrass-four winged saltbush habitat; very unlikely to occur in project construction area based on habitat associations and level of human disturbance
Common black hawk	*Buteogallus anthracinus*	ST	Unlikely to be present on Holloman AFB, as this species prefers riparian gallery forests, a habitat type not present locally
Bald eagle	*Haliaeetus leucocephalus*	ST, FT	Present on Holloman AFB; very unlikely in project construction area due to the absence of river, lake, or very tall tree. Potential visitor to Lake Holloman.
American peregrine falcon	*Falco peregrinus anatum*	ST	Present on Holloman AFB (documented at Lake Holloman); occurrence in project construction area is possible.
Northern aplomado falcon	*Falco femoralis septentrionalis*	SE, FE	Present on Holloman AFB; occurrence in project construction area as a transient is possible but unlikely (has been documented about 3-5 miles to the north)
Snowy plover	*Charadrius alexandrinus*	FBCC	Present on Holloman AFB; occurrence in project construction area is unlikely
Mountain plover	*Charadrius montanus*	SS	Present on Holloman AFB
Long-billed curlew	*Numenius americanus*	FBCC	Present on Holloman AFB
Interior least tern	*Sterna antillarum athalassos*	SE, FE	Present on Holloman AFB
Black tern	*Chlidonias niger*	FSC	Present on Holloman AFB
Western burrowing owl	*Athene cunicularia hypugaea*	FSC, FBCC	Present on Holloman AFB, where nesting has been documented in the past; not documented and unlikely in project construction area
Costa's hummingbird	*Calypte costae*	ST	Present on Holloman AFB
Crissal thrasher	*Toxostoma crissale*	FBCC	Present on Holloman AFB
Southwestern willow flycatcher	*Empidonax traillii extimus*	SE, FE	Unlikely to be present on Holloman AFB due to lack of suitable habitat
Loggerhead shrike	*Lanius ludovicianus*	FSC, FBCC	Present on Holloman AFB

Table 1. Threatened and Endangered Species on or in the Vicinity of Holloman AFB (Page 3 of 3)

Common Name	*Scientific Name*	*Status[1]*	*Potential for occurrence*
Bell's vireo	*Vireo bellii*	ST, FBCC	Unlikely to be present on Holloman AFB
Gray vireo	*Vireo vicinior*	ST, FBCC	Possibly present on Holloman AFB
Sprague's pipit	*Anthus spragueii*	FBCC	Present on Holloman AFB
Cassin's sparrow	*Aimophila cassinii*	FBCC	Present on Holloman AFB
Sage sparrow	*Amphispiza belli*	FBCC	Present on Holloman AFB
Lark bunting	*Calamospiza melanocorys*	FBCC	Present on Holloman AFB
Baird's sparrow	*Ammodramus bairdii*	ST, SSC, FBCC	Present on Holloman AFB
McCown's longspur	*Calcarius mccownii*	FBCC	Present on Holloman AFB
Chestnut-collared longspur	*Calcarius ornatus*	FBCC	Present on Holloman AFB
Reptiles			
Little white whiptail	*Cnemidophorus gypsi*	SS	Likely present on Holloman AFB
Bleached earless lizard	*Holbrookia maculate ruthveni*	SS	Likely present on Holloman AFB
Texas horned lizard	*Phrynosoma cornutum*	FSC	Present on Holloman AFB; occasional in project construction area
White Sands prairie lizard	*Sceloporus undulates cowlesi*	SS	Likely present on Holloman AFB
Fish			
White Sands pupfish	*Cyprinodon tularosa*	ST	Present on Holloman AFB but not in project construction area
Plants and Lichen			
Sacramento prickly poppy	*Argemone pleiacantha pinnatisecta*	SE, FE	Possibly present on Holloman AFB
Kuenzler's hedgehog cactus	*Echinocereus fendleri kuenzleri*	TE, SE	Unlikely to be present on Holloman AFB
Villard pincushion cactus	*Escobaria villardii*	SE, FSC	Possibly present on Holloman AFB
Night-blooming cereus	*Peniocereus greggii*	SE, FSC	Possibly present on Holloman AFB
Paperspine fishhook cactus	*Sclerocactus papyracanthus*	SS, FSC	Present on Holloman AFB
Alamo beardtongue	*Penstemon alamosensis*	SS, FSC	Possibly present on Holloman AFB
Gypsophyllous lichen	*Acarospora clauzadeana*	GI/SI	Present on Holloman AFB

Notes: 1. Status: FBCC = Federal Birds of Conservation Concern; FE = Federal Endangered; FSC = Federal Species of Concern; FT = Federal Threatened; GI/SI = Critically imperiled globally/In-state because of extreme rarity; SE = State Endangered; SS = State Sensitive; ST = State Threatened. See text for information on Federal Birds of Conservation Concern.

Source: Holloman AFB 1998a

Table 2. Federally-listed Threatened, Endangered, and Candidate Species Associated with Counties Intersecting with the Proposed F-22A Training Airspace in New Mexico (Page 1 of 7)

Common Name	*Scientific Name*	*Status*	*Likely Occurrence*	Associated F22 Airspace						
				Beak	*Talon (East & West)*	*McGregor*	*Existing & Expanded WSMR*	*5111A*	*Cowboy/ Expanded Cowboy*	*Valmont ATCAA*
Chiricahua leopard frog	*Rana chiricahuensis*	Threatened	Not likely-Primary NM distribution is west of Rio Grande River				X	X	X	
Sand dune lizard	*Sceloporus arenicolus*	Candidate	Not Likely-Primary NM distribution is east of Pecos River		X				X	X
Noel's amphipod	*Gammarus desperatus*	Endangered	Not Likely-limited to springs around Roswell, NM		X				X	X
Socorro isopod	*Thermosphaeroma thermophilus*	Endangered	Not likely-found in spring west of Socorro				X	X	X	
Alamosa springsnail	*Psuedotryonia alamosae*	Endangered	Not likely-found at the head waters of the Alamosa River				X	X	X	

Table 2. Federally-listed Threatened, Endangered, and Candidate Species Associated with Counties Intersecting with the Proposed F-22A Training Airspace in New Mexico (Page 2 of 7)

Common Name	Scientific Name	Status	Likely Occurrence	Associated F22 Airspace						
				Beak	*Talon (East & West)*	*McGregor*	*Existing & Expanded WSMR*	*5111A*	*Cowboy/ Expanded Cowboy*	*Valmont ATCAA*
Chupadera springsnail	*Pyrgulopsis chupaderae*	Candidate	May Occur- found in the Chupadera Mtns.				X	X	X	
Koster's springsnail	*Juturnia kosteri*	Endangered	Not Likely- limited to springs around Roswell, NM		X				X	X
Pecos assiminea snail	*Assiminea pecos*	Endangered	Not likely- only found around Bitter Lake NWR		X				X	X
Roswell springsnail	*Pyrgulopsis roswellensis*	Endangered	Not Likely- limited to springs around Roswell, NM		X				X	X
Socorro springsnail	*Pyrgulopsis neomexicana*	Endangered	Not likely- found west of San Antonio, NM				X	X	X	
Texas hornshell (mussel)	*Popenaias popei*	Candidate	May occur- on Pecos River near Carlsbad		X				X	X

Table 2. Federally-listed Threatened, Endangered, and Candidate Species Associated with Counties Intersecting with the Proposed F-22A Training Airspace in New Mexico (Page 3 of 7)

Common Name	*Scientific Name*	*Status*	*Likely Occurrence*	Associated F22 Airspace						
				Beak	*Talon (East & West)*	*McGregor*	*Existing & Expanded WSMR*	*5111A*	*Cowboy/ Expanded Cowboy*	*Valmont ATCAA*
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Winter roosts occur on Lincoln NF under the Beak MOA/Cowboy ATCAA	X	X	X	X	X	X	X
Least Tern (Interior Population)	*Sterna antillarum*	Endangered	Not Likely-due to lack of suitable wetland habitat	X	X	X	X	X	X	X
Lesser prairie chicken	*Tympanuchus pallidicinctus*	Candidate	Not likely-primarily occurs east of US-285		X				X	X
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Designated Critical Habitat present in Lincoln NF under the Beak MOA/Cowboy ATCAA and McGregor Airspace.	X	X	X	X	X	X	X

Table 2. Federally-listed Threatened, Endangered, and Candidate Species Associated with Counties Intersecting with the Proposed F-22A Training Airspace in New Mexico (Page 4 of 7)

Common Name	Scientific Name	Status	Likely Occurrence	Associated F22 Airspace						
				Beak	*Talon (East & West)*	*McGregor*	*Existing & Expanded WSMR*	*5111A*	*Cowboy/ Expanded Cowboy*	*Valmont ATCAA*
Northern aplomado falcon	*Falco femoralis septentrionalis*	Endangered	May Occur- suitable habitat is present according to BLM 2005 and Young et al. 2005	X	X	X	X	X	X	X
Piping plover	*Charadrius melodus*	Threatened	Not likely other than rare migratory occurrence				X	X	X	
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Not Likely- duce to lack of riparian habitat	X	X	X	X	X	X	X
Gila trout	*Oncorhynchus gilae*	Endangered	Not likely- occurs west of Rio Grande				X	X		
Pecos bluntnose shiner	*Notropis simus pecosensis*	Threatened	May occur of Pecos south of Fort Sumner, NM		X				X	X

Table 2. Federally-listed Threatened, Endangered, and Candidate Species Associated with Counties Intersecting with the Proposed F-22A Training Airspace in New Mexico (Page 5 of 7)

Common Name	*Scientific Name*	*Status*	*Likely Occurrence*	Associated F22 Airspace						
				Beak	*Talon (East & West)*	*McGregor*	*Existing & Expanded WSMR*	*5111A*	*Cowboy/ Expanded Cowboy*	*Valmont ATCAA*
Pecos gambusia	*Gambusia nobilis*	Endangered	Not likely-occurs on Bitter Lake NWR		X				X	X
Rio Grande silvery minnow	*Hybognathus amarus*	Endangered	Not Likely-existing population limited to the middle Rio Grande				X	X	X	
Black-footed ferret	*Mustela nigripes*	Endangered	No-extirpated from NM	X	X	X	X	X	X	X
Gypsum wild-buckwheat	*Eriogonum gypsophilum*	Threatened	May occur-restricted to gypsum soils		X					
Kuenzler hedgehog cactus	*Echinocereus fendleri var. kuenzleri*	Endangered	May occur-found oak-conifer woodlands	X	X	X	X		X	X
Lee pincushion cactus	*Coryphantha sneedii var. leei*	Threatened	May occur-found in desert scrub		X					
Pecos sunflower	*Helianthus paradoxus*	Threatened	Not likely-due to lack of wetlands		X		X	X	X	X

Table 2. Federally-listed Threatened, Endangered, and Candidate Species Associated with Counties Intersecting with the Proposed F-22A Training Airspace in New Mexico (Page 6 of 7)

Common Name	Scientific Name	Status	Likely Occurrence	Associated F22 Airspace						
				Beak	*Talon (East & West)*	*McGregor*	*Existing & Expanded WSMR*	*5111A*	*Cowboy/ Expanded Cowboy*	*Valmont ATCAA*
Sacramento Mountains thistle	*Cirsium vinaceum*	Threatened	May occur-found in canyons of Sacramento Mnts.	X	X	X	X		X	X
Sacramento prickly poppy	*Argemone pleiacantha spp. pinnatisecta*	Endangered	May occur-found in canyons of Sacramento Mnts.	X	X	X	X		X	X
Sneed pincushion cactus	*Coryphantha sneedii var. sneedii*	Endangered	May occur-found in desert scrub		X		X	X		

Table 2. Federally-listed Threatened, Endangered, and Candidate Species Associated with Counties Intersecting with the Proposed F-22A Training Airspace in New Mexico (Page 7 of 7)

Common Name	Scientific Name	Status	Likely Occurrence	Associated F22 Airspace						
				Beak	*Talon (East & West)*	*McGregor*	*Existing & Expanded WSMR*	*5111A*	*Cowboy/ Expanded Cowboy*	*Valmont ATCAA*
Todsen's pennyroyal	*Hedeoma todsenii*	Endangered	Documented on WSMR in the San Andres Mountains where two 1 km^2 areas of Critical Habitat have been designated in Sierra County. Documented occurrences are within Yonder Impact Area (WSMR) near the northern edge of the safety perimeter outside the live fire area.	X	X	X	X	X	X	X

Sources: NMRPTC 2002, NMDGF 2004

Table 3. Common Wildlife Species and Vegetation Community Association for Lands under the Proposed F-22A Training Airspace in New Mexico (Page 1 of 3)

Species		Community Association		
Scientific Name	*Common Name*	*Plains, Great Basin, and Desert Grassland*	*Shrubland*	*Forest*
Buteo swainsoni	Swainson's hawk	X		X
Buteo jamaicensis	Red-tailed hawk	X		X
Falco mexicanus	Prairie falcon	X		
Athene cunicularia	Burrowing owl	X		
Ammodramus savannarum	Grasshopper sparrow	X		
Calamospiza melancorys	Lark bunting	X		
Peucedramus taeniatus	Olive warbler	X		
Eremophila alpestris	Horned lark	X		
Sturnella neglecta	Western meadowlark	X		
Geococcyx californianus	Greater roadrunner	X		
Campylorhynchus brunneicapillus	Cactus wren		X	
Amphispiza bilineata	Black-throated sparrow		X	
Toxostoma curvirostre	Curve-bill thrasher		X	
Amphispiza belli	Sage sparrow		X	
Oreoscoptes montanus	Sage thrasher		X	
Toxostoma crissale	Crissal thrasher		X	
Pipilo spp.	Towhee		X	
Emipidonax spp.	Empidonax Flycatchers			X
Contopus spp.	Contopus Flycatchers			X
Vireo spp.	Vireo species			X
Junco spp.	Junco species			X
Piranga spp.	Tanager species			X

Table 3. Common Wildlife Species and Vegetation Community Association for Lands under the Proposed F-22A Training Airspace in New Mexico (Page 2 of 3)

Species		Community Association		
Scientific Name	*Common Name*	*Plains, Great Basin, and Desert Grassland*	*Shrubland*	*Forest*
Crotalus atrox	Western diamondback rattlesnake	X	X	X
Holbrookia maculate	Earless lizard	X		
Sceloporus spp.	Fence lizard species	X	X	X
Phrynosoma cornutum	Texas horned lizard	X		
Phrynosoma douglassii	Short-horned lizard	X		
Sceloporus magister	Desert spiny lizard	X		
Scaphiopus bombifrons	Spadefoot toad	X	X	
Masticophis bilineatus	Coachwhip snake	X		
Lampropeltis spp.	Milk snake species	X		
Eumeces spp.	Skink species			X
Ambystoma spp. and *Plethodon* spp.	Salamander species			X
Lampropeltis spp.	Kingsnake species			X
Thamnophis spp.	Garter snake species			X
Arizona elegans	Glossy snake		X	
Leptotyphlops humilis	Western blind snake		X	
Cnemidophorus spp.	Whiptail lizard species		X	
Crotaphytus spp.	Collared lizard species		X	
Uta stansburiana	Side-blotched lizard		X	
Antilocapra americana	Pronghorn antelope	X	X	
Dicotyles tajacu	Javelina	X		
Lepus townsendii	Jackrabbit	X		
Odocoileus hemionus	Mule deer	X	X	X
Cervus elaphus	Elk			X

Table 3. Common Wildlife Species and Vegetation Community Association for Lands under the Proposed F-22A Training Airspace

in New Mexico
(Page 3 of 3)

Species		Community Association		
Scientific Name	***Common Name***	***Plains, Great Basin, and Desert Grassland***	***Shrubland***	***Forest***
Peromyscus eremicus	Deer mice			X
Sciurus spp.	Squirrel species			X
Ovis canadensis	Bighorn sheep		X	
Thomomys spp	Pocket gopher species		X	
Lepus californicus	Blacktail jackrabbit		X	
Dipodomys spp.	Kangaroo rat species		X	

Sources: Dick-Peddie 1993, Bailey 1995.

Ungulates

Wild ungulates appear to vary in sensitivity to aircraft noise. Responses reported in the literature varied from no effect and habituation to panic reactions followed by stampeding (Weisenberger *et al.* 1996; see reviews in Manci *et al.* 1988). Novel or new noises tend to result in a response by an animal, as opposed to regular, predictable noises. Similarly, loud and close aircraft typically result in a more severe response (MacArthur *et al.* 1979, Stockwell *et al.* 1991). Aircraft noise also has the potential to be most detrimental during periods of stress, especially winter, gestation, and calving (DeForge 1981).

Weisenberger *et al.* (1996) measured the heart rate responses of captive bighorn sheep (*Ovis canadensis*) and mule deer (*Odocoileus hemionus*) to simulated aircraft noise ranging from 92 to 112 decibels (dB). For both species, heart rates increased following the simulated aircraft noise, but returned to normal levels within 60–180 seconds. Behavioral responses were relatively rare, and the animals returned to normal behavior within 253 seconds. Furthermore, the animals exhibited decreased responses to increased exposure, suggesting habituation. Similarly, Krausman *et al.* (1998) studied the response of bighorn sheep in a 790-acre enclosure to actual and frequent F-16 overflights at 395 feet AGL. Heart rate increased above preflight level during 7 percent of the overflights but returned to normal within 120 seconds. No behavioral response by the bighorn sheep was observed during the overflights. Luz and Smith (1976) observed that pronghorn antelope (*Antilocapra americana*) did not run until a helicopter was within 150 feet AGL.

Although few studies have been conducted on the response of wild ungulates to sonic booms, they appear to have little to no adverse reactions. Workman *et al.* (1992) studied the physiological and behavioral responses of pronghorn, elk (*Cervus elaphus*), and bighorn sheep to sonic booms. All three species exhibited an increase in heart rate lasting from 30 seconds to 1 ½ minutes in response to their first exposure to a sonic boom. Behaviorally, the animals responded to their first exposure to a sonic boom by running a short distance (less than 30 feet reported for elk). After successive sonic booms, the heart-rate response decreased greatly and the animals remained alert, but did not run. The authors suggested the animals were habituated with successive exposure.

Small Mammals

A few researchers have studied the potential effects of aircraft noise on small mammals. Chesser *et al.* (1975) found that house mice (*Mus musculus*) trapped near an airport runway had larger adrenal glands than those trapped 2 kilometers from the airport. In the lab, naïve mice subjected to simulated aircraft noise also developed larger adrenal glands than a control group. However, the implications of enlarged adrenals for small mammals with a relatively short life span are undetermined. The burrows of some small mammals may reduce their exposure to aircraft noise. Francine *et al.* (1995) found that kit foxes (*Vulpes macrotis*) with twisting tunnels leading to deeper burrows experienced less noise than kangaroo rats (*Dipodomys merriami*) with shallow burrows. McClenaghan and Bowles (1995) studied the effects of aircraft overflights on small mammals and were unable to distinguish potential long-term effects due to aircraft noise compared to other environmental factors.

Raptors

Most studies have found few negative effects of aircraft noise on raptors. Ellis *et al.* (1991) examined behavioral and reproductive responses of several raptor species to low-level flights.

No incidents of reproductive failure were observed and site re-occupancy rates were high (95 percent) the following year. Several researchers found that ground-based activities, such as operating chainsaws or an intruding human, were more disturbing than aircraft (White and Thurow 1985, Grubb and King 1991, Delaney *et al.* 1997). Red-tailed hawks (*Buteo jamaicensis*) and osprey (*Pandion haliaetus*) appeared to readily habituate to regular aircraft overflights (Andersen *et al.* 1989, Trimper *et al.* 1998). Mexican spotted owls (*Strix occidentalis lucida*) did not flush from a nest or perch unless a helicopter was as close as 330 feet (Delaney *et al.* 1997). In Alaska, Palmer *et al.* (2003) found small differences in nest attendance and time-activity budgets between undisturbed nesting peregrine falcons (*Falco peregrinus*) and those that were overflown by military aircraft within 500 feet; however, the differences were not correlated with specific overflights nor did it affect reproductive success. Furthermore, they did not observe a difference in nest-provisioning rates between disturbed and undisturbed nests. On the other hand, Andersen *et al.* (1990) observed a shift in home ranges of four raptor species away from new military helicopter activity, which supports other reports that wild species are more sensitive to rotary wing aircraft than fixed-wing aircraft.

The effects of aircraft noise on the bald eagle (*Haliaetus leucocephalus*) have been studied relatively well, compared to most wildlife species. Overall, there have been no reports of reduced reproductive success or physiological risks to bald eagles exposed to aircraft overflights or other types of military noise (Fraser *et al.* 1985, Stalmaster and Kaiser 1997, Brown *et al.* 1999; see review in Buehler 2000). Most researchers have documented that pedestrians and helicopters were more disturbing to bald eagles than fixed-wing aircraft, including military jets (Fraser *et al.* 1985, Grubb and King 1991, Grubb and Bowerman 1997). Recorded responses to a total of 2849 events involving closely-approaching aircraft (jets, light planes, and helicopters) at median distances of 550 m, ranged from no response (67%), an alert posture (29%), taking flight (3%) or temporarily departing the immediate area (1%). There was considerably more reaction to helicopters than to jets or light planes (Grubb and King 1991). No specific studies were located on the effects of jet aircraft noise on wintering bald eagles.

Waterfowl and Other Waterbirds

In their review, Manci *et al.* (1988) noted that aircraft can be particularly disturbing to waterfowl. Conomy *et al.* (1998) suggested, though, that responses were species-specific. They found that black ducks (*Anas rubripes*) were able to habituate to aircraft noise, while wood ducks (*Aix sponsa*) did not. Black ducks exhibited a significant decrease in startle response to actual and simulated jet aircraft noise over a 17-day period, but wood duck response did not decrease uniformly following initial exposure. Some bird species appear to be more sensitive to aircraft noise at different times of the year. Snow geese (*Chen caerulescens*) were more easily disturbed by aircraft prior to fall migration than at the beginning of the nesting season (Belanger and Bedard 1989). On an autumn staging ground in Alaska (i.e., prior to fall migration), 75 percent of brant (*Branta bernicla*) and only 9 percent of Canada geese (*Branta canadensis*) flew in response to aircraft overflights (Ward *et al.* 1999). There tended to be a greater response to aircraft at 1,000 to 2,500 feet AGL than at lower or higher altitudes. In contrast, Kushlan (1979) did not observe any negative effects to wading bird colonies (i.e., rookeries) when fixed-wing aircraft conducted surveys within 200 feet AGL; 90 percent of the observations indicated no reactions from the birds. Nesting California least terns (*Sterna albifrons browni*) did not respond negatively to a nearby missile launch (Henningson, Durham, and Richardson 1981).

Previous research also shows varied responses of waterbirds to sonic booms. Burger (1981) found that herring gulls (*Larus argentatus*) responded intensively to sonic booms and many eggs were broken as adults flushed from nests. One study discussed by Manci *et al.* (1988) described the reproductive failure of a colony of sooty terns (*Sterna fuscata*) on the Dry Tortugas reportedly due to sonic booms. However, based on laboratory and numerical models, Ting *et al.* (2002) concluded that sonic boom overpressures from military operations of existing aircraft are unlikely to damage avian eggs.

Domestic Animals

As with wildlife, the startle reflex is the most commonly documented effect on domestic animals. Results of the startle reflex are typically minor (e.g., increase in heart rate or nervousness) and do not result in injury. Espmark *et al.* (1974) did not observe any adverse effects due to minor behavioral reactions to low-altitude flights with noise levels of 95 to 101 A-weighted decibels (dBA). They noted only minimal reactions of cattle and sheep to sonic booms, such as muscle and tail twitching and walking or running short distances (up to 65 feet). More severe reactions may occur when animals are crowded in small enclosures, where loud, sudden noise may cause a widespread panic reaction (Air Force 1993). Such negative impacts were typically only observed when aircraft were less than 330 feet AGL (United States Forest Service 1992). Several studies have found little direct evidence of decreased milk production, weight loss, or lower reproductive success in response to aircraft noise or sonic booms. For example, Head *et al.* (1993) did not find any reductions in milk yields with aircraft Sound Exposure Levels (SEL) levels of 105 to 112 dBA. Many studies documented that domestic animals habituate to aircraft noise (see reviews in Manci *et al.* 1998; Head *et al.* 1993).

There is little direct evidence that aircraft noise or sonic booms can cause domestic chicken eggs to crack or result in lower hatching rates. Stadelman (1958) did not observe a decrease in hatchability when domestic chicken eggs were exposed to loud noises measured at 96 dB inside incubators and 120 dB outside. Bowles and Seddon (1994) found no difference in the hatch rate of four groups of chicken eggs exposed to 1) no sonic booms (control group), 2) sonic booms of 3 pounds per square foot (psf), 3) sonic booms of 20 psf, and 4) sonic booms of 30 psf. No eggs were cracked by the sonic booms and all chicks hatched were normal.

Espmark *et al.* (1974) noted only minimal reactions of domestic cattle and sheep to sonic booms, such as muscle and tail twitching and walking or running short distances (up to 65 feet). More severe reactions may occur when domestic animals are crowded within small enclosures where loud, sudden noise may cause a panic reaction. An animal, such as a high strung racehorse, in the footprint of a sonic boom may react to the sharp clap from an aircraft directly overhead, which is different than the rumble they may hear on a regular basis from more distant sonic booms or thunder.

4.3 Training Chaff and Flares

Specific issues and potential impacts of training chaff and flares on biological resources are discussed below. These issues have been identified by Department of Defense (DoD) research (Air Force 1997, Cook 2001), General Accounting Office review (United States General Accounting Office 1998), independent review (Spargo 1999), resource agency instruction, and public concern and perception. No reports to date have documented negative impacts of training chaff and flares to biological resources. These studies are reviewed below.

Concerns for biological resources are related to the residual materials of training chaff and flares that fall to the ground or dud flares. Residual materials include several flare components, such as plastic end caps, felt spacers, aluminum-coated wrapping material, mylar wrapping, plastic retaining devices, and plastic pistons. Specific concerns are the potential for (1) ingestion of chaff fibers or flare residual materials; (2) inhalation of chaff fibers; (3) physical external effects from chaff fibers, such as skin irritation; (4) effects on water quality and forage quality; (5) increased fire risk; and (6) probability of for being struck by large flare debris (the plastic Safe and Initiation [S&I] device of the MJU-7 A/B flare).

Because of the low rate of application and dispersal of training chaff fibers and flare residues during defensive training, wildlife and domestic animals would have little opportunity to ingest, inhale, or otherwise come in contact with these residual materials. Although some chemical components of chaff are toxic at high levels, such levels could only be reached through the ingestion of many chaff bundles or billions of chaff fibers. Barrett and MacKay (1972) documented that cattle avoided consuming clumps of chaff in their feed. When calves were fed chaff thoroughly mixed with molasses in their feed, no adverse physiological effects were observed pre- or post-mortem.

Chaff fibers are too large for inhalation, although chaff particles can degrade to small pieces. However, the number of degraded or fragmented particles is insufficient to result in disease (Spargo 1999). Chaff is similar in form and softness to very fine human hair, and is unlikely to cause negative reactions if animals were to inadvertently come in contact with it.

Chaff fibers could accumulate on the ground or in water bodies. Studies have shown that chaff breaks down quickly in humid environments and acidic soil conditions (Air Force 1997). In water, only under very high or low pH could the aluminum in chaff become soluble and toxic (Air Force 1997). Few organisms would be present in water bodies with such extreme pH levels. Given the small amount of diffuse or aggregate chaff material that could possibly reach water bodies, water chemistry would not be expected to be affected. Similarly, the magnesium in flares can be toxic at extremely high levels, a situation that could occur only under repeated and concentrated use in localized areas. Flare ash would disperse over wide areas; thus, no impact is expected from the magnesium in flare ash. The probability of an intact dud flare leaving an aircraft during training and falling to the ground outside of a military base is estimated to be 0.01 percent (Air Force 2001). Since toxic levels would require several dud flares to fall in one confined water body, no effect of flares on water quality would be expected. Furthermore, uptake by plants would not be expected to occur.

The expected frequency of an S&I device from an MJU-7 A/B flare striking an exposed animal depends on the number of flares used and the size and population density of the exposed animals. Calculations of potential strikes to a human-sized animal with a density of 50 animals per square mile, where 8,000 flares were used annually, was one strike in 200 years. An animal 1/100th the size of a human with a density of 500 animals per square mile exposed 100 percent of the time (i.e., animals not protected by burrows or dense vegetation) would also have an expected strike rate of one in 200 years. The S&I device strikes with the force of a medium-sized hailstone. Such a strike to a bird, small mammal, or reptile could produce a mortality. The very small likelihood of such a strike, especially when compared with more immediate threats such as highways, would not be expected to have any effect on populations of small species. Strikes to larger species, such as wild ungulates or farm animals could produce a bruise and a startle reaction. Such a strike from an S&I device would not be expected to seriously injure or otherwise significantly affect natural or domestic species.

Flare debris also includes aluminum-coated mylar wrapping and plastic parts (see Appendix C). The plastic parts, such as end caps, are inert and are not expected to be used by or consumed by any species. Mylar degrades when exposed to sunlight and is not expected to be consumed or otherwise used by native or domestic species. The mylar wrapping on chaff is a new innovation that has not yet had extensive observation in the natural environment. The aluminum coated wrapping on flares, as it degrades, could produce fibrous materials similar to naturally occurring nesting materials. Human observers on an active range observed that the residual flare wrappings had the appearance of a twisted root. There is no known case of such materials being used in nest construction. In a study of pack rats (*Neotoma* spp.), a notorious collector of odd materials, no chaff or flare materials were found in nests on military ranges subject to decades of dispensing chaff and flares (Air Force 1997). Although lighter flare debris could be used by species under the airspace, such use would be expected to be infrequent and incidental.

Public commentors have asked whether a piece of chaff or flare residual material could cause bovine hardware disease in domestic feed lot or dairy cattle. Hardware disease, or traumatic reticuloperitonitis, is a relatively common disease in cattle. The disease results when a cow ingests a foreign object, typically a nail, piece of wire, or other metallic object. The object can become lodged in the wall of the stomach and can penetrate into the diaphragm and heart, resulting in pain and infection; in severe cases animals can die without treatment. Treatment consists of antibiotics and/or surgery. Statistics are not readily available, but one study documented that 55-75 percent of cattle slaughtered in the eastern United States (U.S.) had metallic objects in their stomachs, but the objects did not result in damage (Moseley 2003). Dairy cattle are typically more vulnerable to hardware disease due to the confined nature of diary operations. Many livestock managers rely on magnets inserted into the cow's stomach to prevent and treat hardware disease. The magnet attracts metallic objects, thereby preventing them from traveling to the stomach wall.

The culprit of bovine hardware disease is often a nail or piece of wire greater than 1 inch in length, such as that used to bale hay (Cavedo et al. 2004). If livestock ingested residual materials of the MJU-10/B flare or chaff, the plastic materials of the end cap and slider and the flexible aluminum wrapping do not have pointed edges nor the penetration capability of a nail or piece of wire. Residual chaff or flare materials would be less likely to result in injury than a metallic object.

Flares used for training by F-22A aircraft are designed to burn out within approximately 400 feet of the release altitude. Given the minimum allowable release altitudes for flares, this leaves an extensive safety margin to prevent any burning materials from reaching the ground (Air Force 2001). In the training airspace, flares must be released above 2,000 feet AGL to reduce any potential of a flare-caused fire. When very high or extreme fire conditions exist, Holloman AFB would discontinue flare use. Plastic and aluminum coated wrapping materials from flares that do reach the ground would be inert. The percentage of flares that malfunction is small (<1 percent probability for all categories of malfunction; Air Force 2001). Dud flares (i.e., those that do not ignite at release and fall intact to the ground) contain magnesium, which is thermally stable. Self-ignition is highly unlikely under natural conditions. If a dud flare were located, it should be left alone and its location provided to safety authorities.

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