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***APPENDIX I***  
***NOISE***

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# APPENDIX I NOISE

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Noise is generally described as unwanted sound. Unwanted sound can be based on objective effects (such as hearing loss or damage to structures) or subjective judgments (community annoyance). Noise analysis thus requires a combination of physical measurement of sound, physical and physiological effects, plus psycho- and socio-acoustic effects.

Section 1.0 of this appendix describes how sound is measured and summarizes noise impacts in terms of community acceptability and land use compatibility. Section 2.0 gives detailed descriptions of the effects of noise that lead to the impact guidelines presented in Section 1.0. Section 3.0 provides a description of the specific methods used to predict aircraft noise, including a detailed description of sonic booms.

## 1.0 NOISE DESCRIPTORS AND IMPACT

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Aircraft operating in military airspace generate two types of sound. One is “subsonic” noise, which is continuous sound generated by the aircraft’s engines and also by air flowing over the aircraft itself. The other is sonic booms (where authorized for supersonic), which are transient impulsive sounds generated during supersonic flight. These are quantified in different ways.

Section 1.1 describes the characteristics which are used to describe sound. Section 1.2 describes the specific noise metrics used for noise impact analysis. Section 1.3 describes how environmental impact and land use compatibility are judged in terms of these quantities.

### 1.1 QUANTIFYING SOUND

Measurement and perception of sound involve two basic physical characteristics: amplitude and frequency. Amplitude is a measure of the strength of the sound and is directly measured in terms of the pressure of a sound wave. Because sound pressure varies in time, various types of pressure averages are usually used. Frequency, commonly perceived as pitch, is the number of times per second the sound causes air molecules to oscillate. Frequency is measured in units of cycles per second, or hertz (Hz).

**Amplitude.** The loudest sounds the human ear can comfortably hear have acoustic energy one trillion times the acoustic energy of sounds the ear can barely detect. Because of this vast range, attempts to represent sound amplitude by pressure are generally unwieldy. Sound is, therefore, usually represented on a logarithmic scale with a unit called the decibel (dB). Sound measured on the decibel scale is referred to as a sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

Because of the logarithmic nature of the decibel scale, sounds levels do not add and subtract directly and are somewhat cumbersome to handle mathematically. However, some simple rules of thumb are useful in dealing with sound levels. First, if a sound’s intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

60 dB + 60 dB = 63 dB, and

80 dB + 80 dB = 83 dB.

The total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

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Because the addition of sound levels behaves differently than that of ordinary numbers, such addition is often referred to as “decibel addition” or “energy addition.” The latter term arises from the fact that the combination of decibel values consists of first converting each decibel value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its decibel equivalent.

The difference in dB between two sounds represents the ratio of the amplitudes of those two sounds. Because human senses tend to be proportional (i.e., detect whether one sound is twice as big as another) rather than absolute (i.e., detect whether one sound is a given number of pressure units bigger than another), the decibel scale correlates well with human response.

Under laboratory conditions, differences in sound level of 1 dB can be detected by the human ear. In the community, the smallest change in average noise level that can be detected is about 3 dB. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound’s loudness, and this relation holds true for loud sounds and for quieter sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound *intensity* but only a 50 percent decrease in perceived *loudness* because of the nonlinear response of the human ear (similar to most human senses).

The one exception to the exclusive use of levels, rather than physical pressure units, to quantify sound is in the case of sonic booms. As described in Section 3.2, sonic booms are coherent waves with specific characteristics. There is a long-standing tradition of describing individual sonic booms by the amplitude of the shock waves, in pounds per square foot (psf). This is particularly relevant when assessing structural effects as opposed to loudness or cumulative community response. In this environmental analysis, sonic booms are quantified by either dB or psf, as appropriate for the particular impact being assessed.

**Frequency.** The normal human ear can hear frequencies from about 20 Hz to about 20,000 Hz. It is most sensitive to sounds in the 1,000 to 4,000 Hz range. When measuring community response to noise, it is common to adjust the frequency content of the measured sound to correspond to the frequency sensitivity of the human ear. This adjustment is called A-weighting (American National Standards Institute 1988). Sound levels that have been so adjusted are referred to as A-weighted sound levels.

The audible quality of high thrust engines in modern military combat aircraft can be somewhat different than other aircraft, including (at high throttle settings) the characteristic nonlinear crackle of high thrust engines. The spectral characteristics of various noises are accounted for by A-weighting, which approximates the response of the human ear but does not necessarily account for quality. There are other, more detailed, weighting factors that have been applied to sounds. In the 1950s and 1960s, when noise from civilian jet aircraft became an issue, substantial research was performed to determine what characteristics of jet noise were a problem. The metrics Perceived Noise Level and Effective Perceived Noise Level were developed. These accounted for nonlinear behavior of hearing and the importance of low frequencies at high levels, and for many years airport/airbase noise contours were presented in terms of Noise Exposure Forecast, which was based on Perceived Noise Level and Effective Perceived Noise Level. In the 1970s, however, it was realized that the primary intrusive aspect of aircraft noise was the high noise level, a factor which is well represented by A-weighted levels and day-night average sound level (DNL). The refinement of Perceived Noise Level, Effective Perceived Noise Level, and Noise Exposure Forecast was not significant in protecting the public from noise.

There has been continuing research on noise metrics and the importance of sound quality, sponsored by the Department of Defense (DoD) for military aircraft noise and by the Federal Aviation Administration



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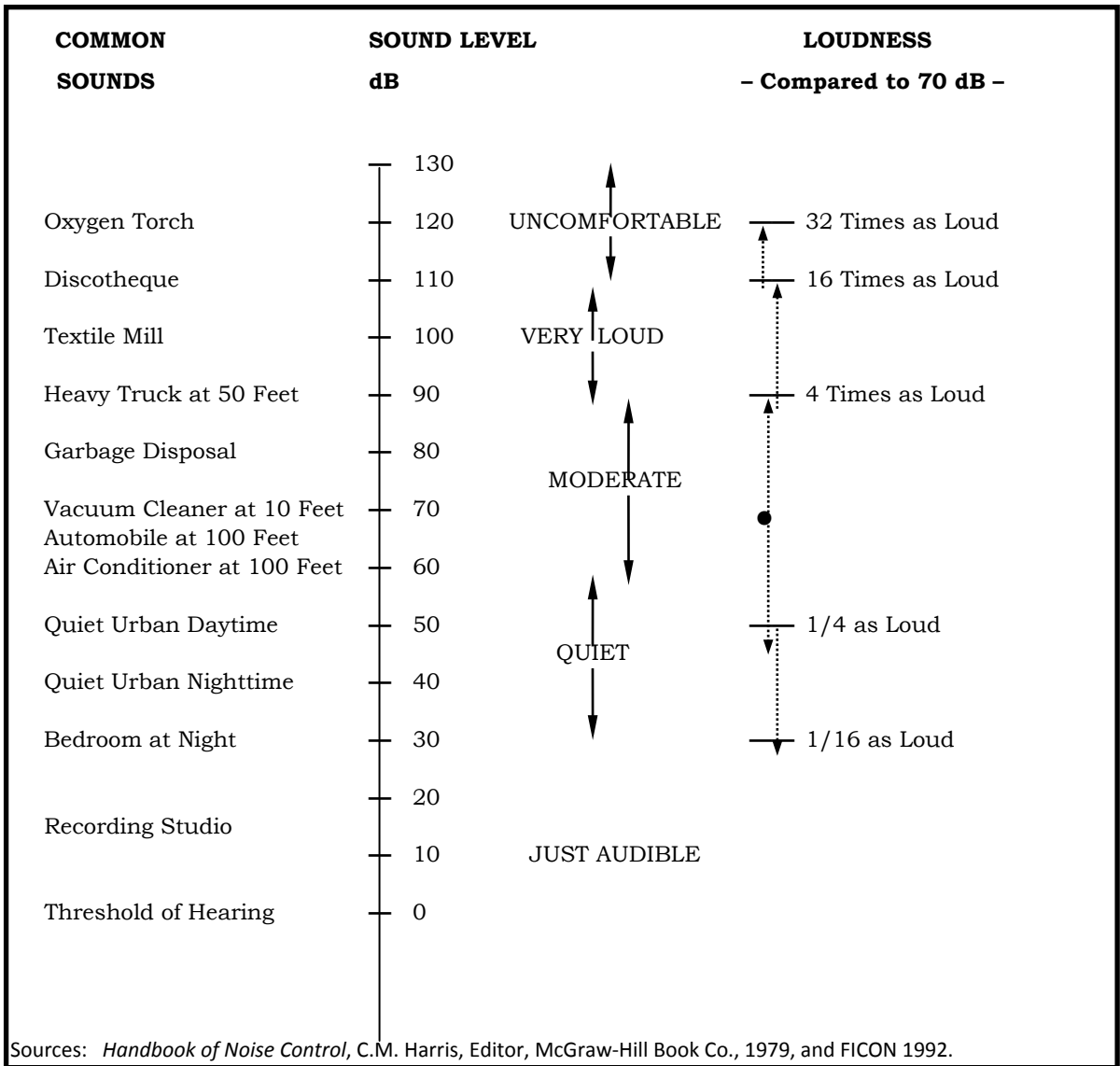
(FAA) for civil aircraft noise. The metric  $L_{dnmr}$ , which is described later and accounts for the increased annoyance of rapid onset rate of sound, is a product of this long-term research.

The amplitude of A-weighted sound levels is measured in dB. It is common for some noise analysts to denote the unit of A-weighted sounds by dBA. As long as the use of A-weighting is understood, there is no difference between dB or dBA: it is only important that the use of A-weighting be made clear. In this environmental analysis, A-weighted sound levels are reported as dB.

A-weighting is appropriate for continuous sounds, which are perceived by the ear. Impulsive sounds, such as sonic booms, are perceived by more than just the ear. When experienced indoors, there can be secondary noise from rattling of the building. Vibrations may also be felt. C-weighting (American National Standards Institute 1988) is applied to such sounds. This is a frequency weighting that is relatively flat over the range of human hearing (about 20 Hz to 20,000 Hz) that rolls off above 5,000 Hz and below 50 Hz. In this study, C-weighted sound levels are used for the assessment of sonic booms and other impulsive sounds. As with A-weighting, the unit is dB, but dBC is sometimes used for clarity. In this study, sound levels are reported in both A-weighting and C-weighting dBs, and C-weighted metrics are denoted when used.

**Time Averaging.** Sound pressure of a continuous sound varies greatly with time, so it is customary to deal with sound levels that represent averages over time. Levels presented as instantaneous (i.e., as might be read from the display of a sound level meter) are based on averages of sound energy over either 1/8 second (fast) or 1 second (slow). The formal definitions of fast and slow levels are somewhat complex, with details that are important to the makers and users of instrumentation. They may, however, be thought of as levels corresponding to the root-mean-square sound pressure measured over the 1/8-second or 1-second periods.

The most common uses of the fast or slow sound level in environmental analysis is in the discussion of the maximum sound level that occurs from the action, and in discussions of typical sound levels. Figure I-1 is a chart of A-weighted sound levels from typical sounds. Some (air conditioner, vacuum cleaner) are continuous sounds whose levels are constant for some time. Some (automobile, heavy truck) are the maximum sound during a vehicle pass-by. Some (urban daytime, urban nighttime) are averages over some extended period. A variety of noise metrics have been developed to describe noise over different time periods. These are described in Section 1.2.



**Figure I-1. Typical A-Weighted Sound Levels of Common Sounds**

## 1.2 NOISE METRICS

### **MAXIMUM SOUND LEVEL**

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level or maximum sound level, for short. It is usually abbreviated by ALM,  $L_{max}$ , or  $L_{Amax}$ . The maximum sound level is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleeping, or other common activities. Table I-1 reflects  $L_{max}$  values for typical aircraft associated with this assessment operating at the indicated flight profiles and power settings.

**Table I-1. Representative Maximum Sound Levels ( $L_{max}$ )**

Aircraft (engine type)	Power Setting	Power Unit	$L_{MAX}$ VALUES (IN DBA) AT VARYING DISTANCES (IN FEET)				
			500	1,000	2,000	5,000	10,000
<b>Takeoff/Departure Operations (at 300 knots airspeed)</b>							
A-10A	6200	NF	99.9	91.7	82.2	68.2	57.8
B-1	97.5%	RPM	126.5	118.3	109.9	98.3	88.7
F-15 (P220)	90%	NC	111.4	104.3	96.6	85	74.7
F-16 (P229)	93%	NC	113.7	106.2	98.1	86.1	75.7
F-22	100%	ETR	119.7	112.4	104.6	93	82.9
<b>Landing/Arrival Operations (at 160 knots airspeed)</b>							
A-10A	5225	NF	97	88.9	78.8	60.2	46.4
B-1	90%	RPM	98.8	91.9	84.5	72.8	62
F-15 (P220)	75%	NC	88.5	81.6	74.3	63.2	53.4
F-16 (P229)	83.5%	NC	92.6	85.5	77.8	66.1	55.6
F-22	43%	ETR	111.3	103.9	95.9	83.9	73.1

Engine Unit of Power: RPM—Revolutions Per Minute; ETR—Engine Thrust Ratio; NC—Engine Core RPM; and NF—Engine Fan RPM.

Source: SELCalc2 (Flyover Noise Calculator), Using Noisemap 6/7 and Maximum Omega10 Result as the defaults.

### **PEAK SOUND LEVEL**

For impulsive sounds, the true instantaneous sound pressure is of interest. For sonic booms, this is the peak pressure of the shock wave, as described in Section 3.2 of this appendix. This pressure is usually presented in physical units of pounds per square foot. Sometimes it is represented on the decibel scale, with symbol  $L_{pk}$ . Peak sound levels do not use either A or C weighting.

### **SOUND EXPOSURE LEVEL**

Individual time-varying noise events have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. Although the maximum sound level, described above, provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The Sound Exposure Level (abbreviated SEL or  $L_{AE}$  for A-weighted sounds) combines both of these characteristics into a single metric.

SEL is a composite metric that represents both the intensity of a sound and its duration. Mathematically, the mean square sound pressure is computed over the duration of the event, then multiplied by the duration in seconds, and the resultant product is turned into a sound level. It does not

directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that SEL measures this impact much more reliably than just the maximum sound level. Table I-2 shows SEL values corresponding to the aircraft and power settings reflected in Table I-1.

**Table I-2. Representative Sound Exposure Levels (SEL)**

Aircraft (engine type)	Power Setting	Power Unit	SEL VALUES (IN DBA) AT VARYING DISTANCES (IN FEET)				
			500	1,000	2,000	5,000	10,000
<b>Takeoff/Departure Operations (at 300 knots airspeed)</b>							
A-10A	6200	NF	102.6	96.2	88.5	76.9	68.3
B-1	97.5%	RPM	129.5	123.1	116.5	107.3	99.3
F-15 (P220)	90%	NC	117.3	112	106.1	97	88.4
F-16 (P229)	93%	NC	116.5	110.8	104.6	95	86.3
F-22	100%	ETR	124.2	118.7	112.7	103.5	95.2
<b>Landing/Arrival Operations (at 160 knots airspeed)</b>							
A-10A	5225	NF	97.9	91.5	83.3	67	55
B-1	90%	RPM	103.4	98.3	92.7	83.4	74.4
F-15 (P220)	75%	NC	94.2	89.2	83.6	74.9	66.9
F-16 (P229)	83.5%	NC	97.4	92.1	86.3	76.9	68.2
F-22	43%	ETR	114.9	109.3	103.1	93.5	84.5

Engine Unit of Power: RPM—Revolutions Per Minute; ETR—Engine Thrust Ratio; NC—Engine Core RPM; and NF—Engine Fan RPM.

Source: SELCalc2 (Flyover Noise Calculator), Using Noisemap 6/7 and Maximum Omega10 Result as the defaults.

Because the SEL and the maximum sound level are both used to describe single events, there is sometimes confusion between the two, so the specific metric used should be clearly stated.

SEL can be computed for C-weighted levels (appropriate for impulsive sounds), and the results denoted CSEL or  $L_{CE}$ . SEL for A-weighted sound is sometimes denoted ASEL. Within this study, SEL is used for A-weighted sounds and CSEL for C-weighted.

### **EQUIVALENT SOUND LEVEL**

For longer periods of time, total sound is represented by the equivalent continuous sound pressure level ( $L_{eq}$ ).  $L_{eq}$  is the average sound level over some time period (often an hour or a day, but any explicit time span can be specified), with the averaging being done on the same energy basis as used for SEL. SEL and  $L_{eq}$  are closely related, with  $L_{eq}$  being SEL over some time period normalized by that time.

Just as SEL has proven to be a good measure of the noise impact of a single event,  $L_{eq}$  has been established to be a good measure of the impact of a series of events during a given time period. Also, while  $L_{eq}$  is defined as an average, it is effectively a sum over that time period and is, thus, a measure of the cumulative impact of noise.

### **DAY-NIGHT AVERAGE SOUND LEVEL**

Noise tends to be more intrusive at night than during the day. This effect is accounted for by applying a 10 dB penalty to events that occur after 10 pm and before 7 am. If  $L_{eq}$  is computed over a 24-hour period with this nighttime penalty applied, the result is the DNL. DNL is the community noise metric recommended by the USEPA (United States Environmental Protection Agency [USEPA] 1974) and has been adopted by most federal agencies (Federal Interagency Committee on Noise 1992). It has been

well established that DNL correlates well with long-term community response to noise (Schultz 1978; Finegold *et al.* 1994). This correlation is presented in Section 1.3 of this appendix.

DNL accounts for the total, or cumulative, noise impact at a given location, and for this reason is often referred to as a “cumulative” metric.

It was noted earlier that, for impulsive sounds, such as sonic booms, C-weighting is more appropriate than A-weighting. The day-night average sound level computed with C-weighting is denoted CDNL or  $L_{Cdn}$ . This procedure has been standardized, and impact interpretive criteria similar to those for DNL have been developed (Committee on Hearing, Bioacoustics and Biomechanics 1981).

### ***ONSET-ADJUSTED MONTHLY DAY-NIGHT AVERAGE SOUND LEVEL***

Aircraft operations in military training airspace generate a noise environment somewhat different from other community noise environments. Overflights are sporadic, occurring at random times and varying from day to day and week to week. This situation differs from most community noise environments, in which noise tends to be continuous or patterned. Individual military overflight events also differ from typical community noise events in that noise from a low-altitude, high-air-speed flyover can have a rather sudden onset.

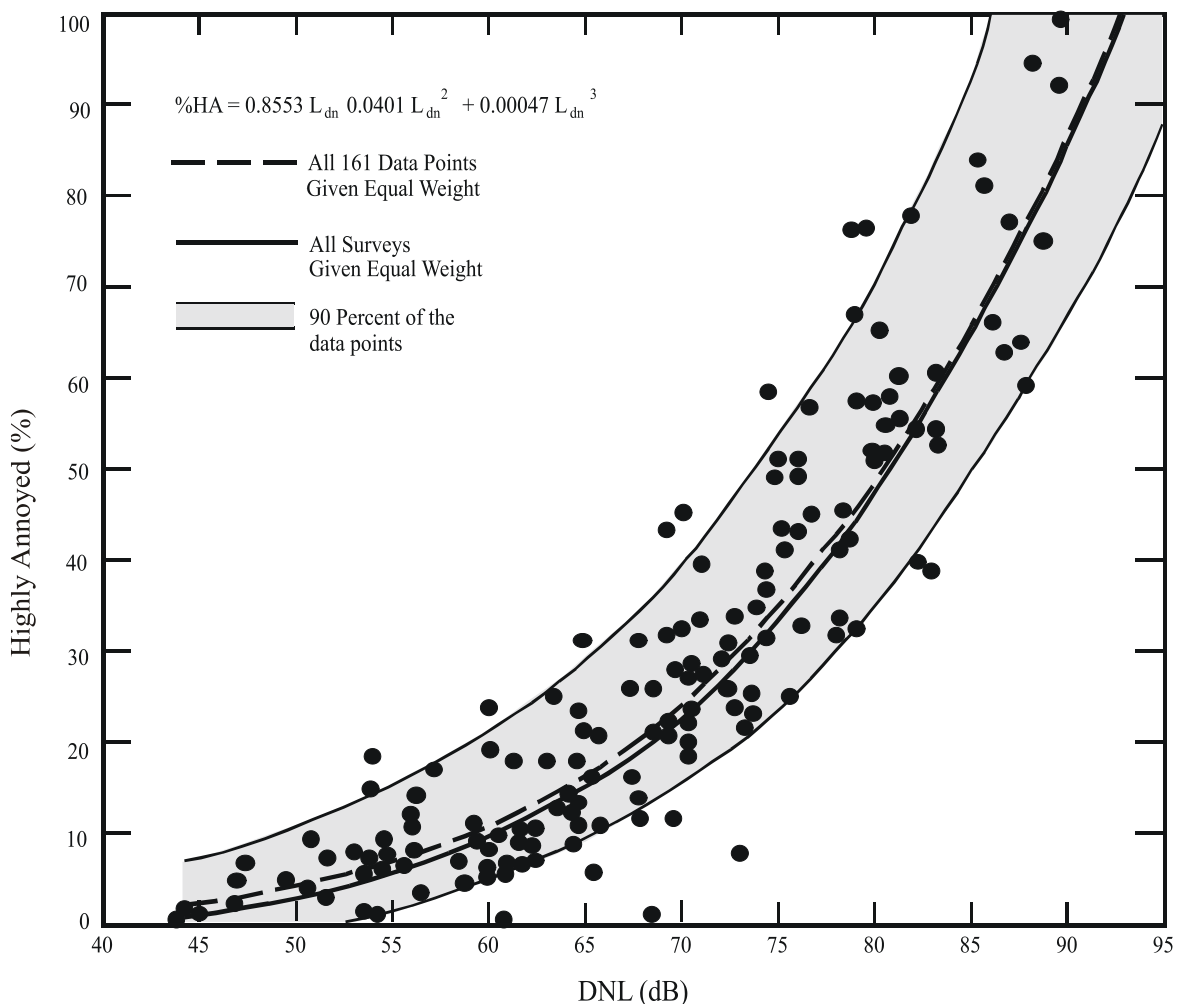
To represent these differences, the conventional DNL metric is adjusted to account for the “surprise” effect of the sudden onset of aircraft noise events on humans (Plotkin *et al.* 1987; Stusnick *et al.* 1992; Stusnick *et al.* 1993). For aircraft exhibiting a rate of increase in sound level (called onset rate) of from 15 to 150 dB per second, an adjustment or penalty ranging from 0 to 11 dB is added to the normal SEL. Onset rates above 150 dB per second require an 11 dB penalty, while onset rates below 15 dB per second require no adjustment. The DNL is then determined in the same manner as for conventional aircraft noise events and is designated as Onset-Rate Adjusted Day-Night Average Sound Level (abbreviated  $L_{dnmr}$ ).

Because of the irregular occurrences of aircraft operations, the number of average daily operations is determined by using the calendar month with the highest number of operations. The monthly average is denoted  $L_{dnmr}$ . Noise levels are calculated the same way for both DNL and  $L_{dnmr}$ .  $L_{dnmr}$  is interpreted by the same criteria as used for DNL.

## **1.3 NOISE IMPACT**

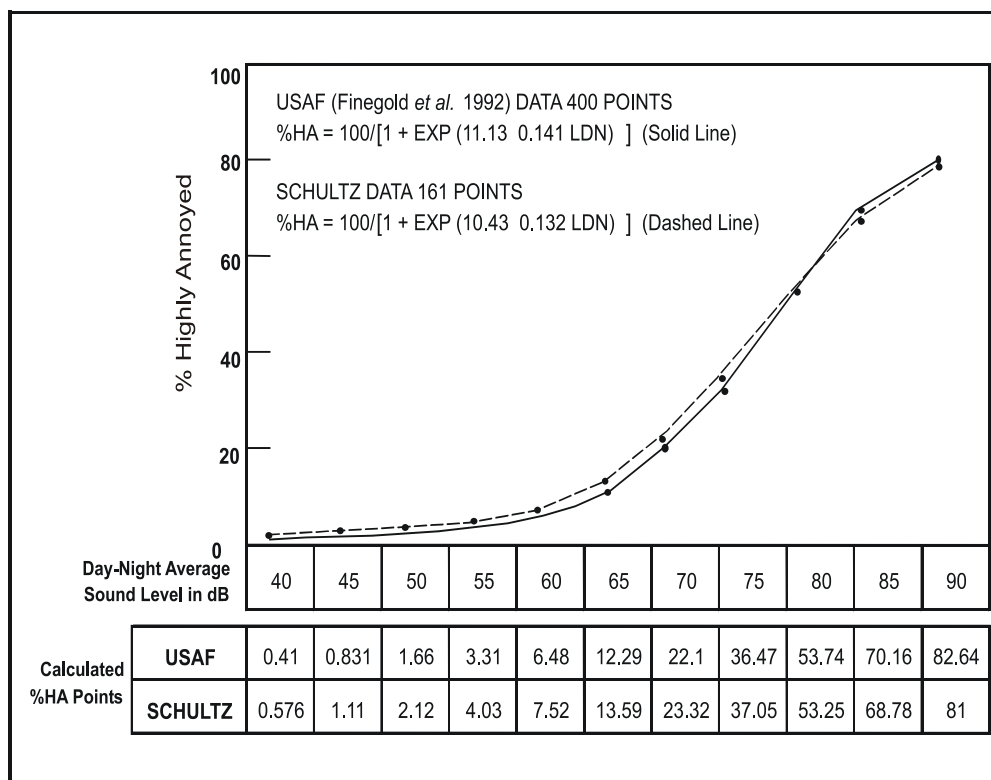
### ***COMMUNITY REACTION***

Studies of long-term community annoyance to numerous types of environmental noise show that DNL correlates well with the annoyance. Schultz (1978) showed a consistent relationship between DNL and annoyance. Schultz’s original curve fit (Figure I-2) shows that there is a remarkable consistency in results of attitudinal surveys which relate the percentages of groups of people who express various degrees of annoyance when exposed to different DNL.



**Figure I-2. Community Surveys of Noise Annoyance**

A more recent study has reaffirmed this relationship (Fidell *et al.* 1991). Figure I-3 (Federal Interagency Committee on Noise 1992) shows an updated form of the curve fit (Finegold *et al.* 1994) in comparison with the original. The updated fit, which does not differ substantially from the original, is the current preferred form. In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low, however, on the order of 0.5 or less. This is not surprising, considering the varying personal factors that influence the manner in which individuals react to noise. Nevertheless, findings substantiate that community annoyance to aircraft noise is represented quite reliably using DNL.



**Figure I-3. Response of Communities to Noise; Comparison of Original (Schultz 1978) and Current (Finegold *et al.* 1994) Curve Fits**

As noted earlier for SEL, DNL does not represent the sound level heard at any particular time, but rather represents the total sound exposure. DNL accounts for the sound level of individual noise events, the duration of those events, and the number of events. Its use is endorsed by the scientific community (American National Standards Institute 1980, 1988, 2005; USEPA 1974; Federal Interagency Committee on Urban Noise 1980; Federal Interagency Committee on Noise 1992).

While DNL is the best metric for quantitatively assessing cumulative noise impact, it does not lend itself to intuitive interpretation by non-experts. Accordingly, it is common for environmental noise analyses to include other metrics for illustrative purposes. A general indication of the noise environment can be presented by noting the maximum sound levels which can occur and the number of times per day noise events will be loud enough to be heard. Use of other metrics as supplements to DNL has been endorsed by federal agencies (Federal Interagency Committee on Noise 1992).

The Schultz curve is generally applied to annual average DNL. In Section 1.2,  $L_{dnmr}$  was described and presented as being appropriate for quantifying noise in military airspace. The Schultz curve is used with  $L_{dnmr}$  as the noise metric.  $L_{dnmr}$  is always equal to or greater than DNL, so impact is generally higher than would have been predicted if the onset rate and busiest-month adjustments were not accounted for.

There are several points of interest in the noise-annoyance relation. The first is DNL of 65 dB. This is a level most commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like aviation which do cause noise. Areas exposed to DNL above 65 dB are generally not considered suitable for residential use. The second is DNL of 55 dB, which was identified by USEPA as a level "...requisite to protect the public health and welfare with an adequate margin of safety," (USEPA 1974) which is essentially a level below which adverse impact is not expected. The third is DNL of 75 dB. This is the lowest level at which adverse health effects could be credible

(USEPA 1974). The very high annoyance levels correlated with DNL of 75 dB make such areas unsuitable for residential land use.

Sonic boom exposure is measured by C-weighting, with the corresponding cumulative metric being CDNL. Correlation between CDNL and annoyance has been established, based on community reaction to impulsive sounds (Committee on Hearing, Bioacoustics and Biomechanics 1981). Values of the C-weighted equivalent to the Schultz curve are different than that of the Schultz curve itself. Table I-3 shows the relation between annoyance, DNL, and CDNL.

**Table I-3. Relation Between Annoyance, DNL and CDNL**

<i>DNL</i>	<i>% Highly Annoyed</i>	<i>CDNL</i>
45	0.83	42
50	1.66	46
55	3.31	51
60	6.48	56
65	12.29	60
70	22.10	65

Interpretation of CDNL from impulsive noise is accomplished by using the CDNL versus annoyance values in Table I-3. CDNL can be interpreted in terms of an “equivalent annoyance” DNL. For example, CDNL of 52, 61, and 69 dB are equivalent to DNL of 55, 65, and 75 dB, respectively. If both continuous and impulsive noise occurs in the same area, impacts are assessed separately for each.

### **LAND USE COMPATIBILITY**

As noted above, the inherent variability between individuals makes it impossible to predict accurately how any individual will react to a given noise event. Nevertheless, when a community is considered as a whole, its overall reaction to noise can be represented with a high degree of confidence. As described above, the best noise exposure metric for this correlation is the DNL or  $L_{dnmr}$  for military overflights. Impulsive noise can be assessed by relating CDNL to an “equivalent annoyance” DNL, as outlined in Section 1.3.1.

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise published guidelines (Federal Interagency Committee on Urban Noise 1980) relating DNL to compatible land uses. This committee was composed of representatives from DoD, Transportation, and Housing and Urban Development; USEPA; and the Veterans Administration. Since the issuance of these guidelines, federal agencies have generally adopted these guidelines for their noise analyses.

Following the lead of the committee, DoD and FAA adopted the concept of land-use compatibility as the accepted measure of aircraft noise effect. The FAA included the committee’s guidelines in the Federal Aviation Regulations (United States Department of Transportation 1984). These guidelines are reprinted in Table I-4, along with the explanatory notes included in the regulation. Although these guidelines are not mandatory (note the footnote “\*” in the table), they provide the best means for determining noise impact in airport communities. In general, residential land uses normally are not compatible with outdoor DNL values above 65 dB, and the extent of land areas and populations exposed to DNL of 65 dB and higher provides the best means for assessing the noise impacts of alternative aircraft actions. In some cases a change in noise level, rather than an absolute threshold, may be a more appropriate measure of impact. The FAA recognizes that there are settings where the 65 dB DNL standard may not apply. Special consideration needs to be given to the evaluation of the significance of noise impacts on noise sensitive areas within national parks, national wildlife refuges and historic sites, including traditional cultural properties.



**Table I-4. Land-Use Compatibility With Yearly  
Day-Night Average Sound Levels**

<b>Land Use</b>	<b>YEARLY DAY-NIGHT AVERAGE SOUND LEVEL (DNL) IN DECIBELS</b>					
	<b>Below 65</b>	<b>65–70</b>	<b>70–75</b>	<b>75–80</b>	<b>80–85</b>	<b>Over 85</b>
<b>Residential</b>						
Residential, other than mobile homes and transient lodgings ..	Y	N <sup>1</sup>	N <sup>1</sup>	N	N	N
Mobile home parks .....	Y	N	N	N	N	N
Transient lodgings.....	Y	N <sup>1</sup>	N <sup>1</sup>	N <sup>1</sup>	N	N
<b>Public Use</b>						
Schools.....	Y	N <sup>1</sup>	N <sup>1</sup>	N	N	N
Hospitals and nursing homes.....	Y	25	30	N	N	N
Churches, auditoria, and concert halls.....	Y	25	30	N	N	N
Government services .....	Y	Y	25	30	N	N
Transportation .....	Y	Y	Y <sup>2</sup>	Y <sup>3</sup>	Y <sup>4</sup>	Y <sup>4</sup>
Parking .....	Y	Y	Y <sup>2</sup>	Y <sup>3</sup>	Y <sup>4</sup>	N
<b>Commercial Use</b>						
Offices, business and professional .....	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware, and farm equipment.....	Y	Y	Y <sup>2</sup>	Y <sup>3</sup>	Y <sup>4</sup>	N
Retail trade—general.....	Y	Y	25	30	N	N
Utilities.....	Y	Y	Y <sup>2</sup>	Y <sup>3</sup>	Y <sup>4</sup>	N
Communication.....	Y	Y	25	30	N	N
<b>Manufacturing and Production</b>						
Manufacturing, general .....	Y	Y	Y <sup>2</sup>	Y <sup>3</sup>	Y <sup>4</sup>	N
Photographic and optical.....	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry .....	Y	Y <sup>6</sup>	Y <sup>7</sup>	Y <sup>8</sup>	Y <sup>8</sup>	Y <sup>8</sup>
Livestock farming and breeding.....	Y	Y <sup>6</sup>	Y <sup>7</sup>	N	N	N
Mining and fishing, resource production and extraction.....	Y	Y	Y	Y	Y	Y
<b>Recreational</b>						
Outdoor sports arenas and spectator sports .....	Y	Y <sup>5</sup>	Y <sup>5</sup>	N	N	N
Outdoor music shells, amphitheaters .....	Y	N	N	N	N	N
Nature exhibits and zoos.....	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps .....	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation .....	Y	Y	25	30	N	N

\* The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise-compatible land uses.

Key:

Y (YES) = Land Use and related structures compatible without restrictions.

N (No) = Land Use and related structures are not compatible and should be prohibited.

NLR = Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35 = Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structures.

Notes:

1. Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor NLR of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide an NLR of 20 dB; thus the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2. Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

3. Measures to achieve NLR 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

4. Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

5. Land-use compatible provided special sound reinforcement systems are installed.

6. Residential buildings require an NLR of 25.

7. Residential buildings require an NLR of 30.

8. Residential buildings not permitted.

## **2.0 NOISE EFFECTS**

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The discussion in Section 1.3 presents the global effect of noise on communities. The following sections describe particular noise effects.

### **2.1 HEARING LOSS**

Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of 90 dB over an 8-hour work period, or 85 dB averaged over a 16-hour period. Even the most protective criterion (no measurable hearing loss for the most sensitive portion of the population at the ear's most sensitive frequency, 4,000 Hz, after a 40-year exposure suggests a time-average sound level of 70 dB over a 24-hour period (USEPA 1974). Since it is unlikely that airport neighbors will remain outside their homes 24 hours per day for extended periods of time, there is little possibility of hearing loss below a DNL of 75 dB, and this level is extremely conservative.

### **2.2 NONAUDITORY HEALTH EFFECTS**

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor, have not been found to occur at levels below those protective against noise-induced hearing loss, described above. Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institutes of Health Conference on Noise and Hearing Loss, held on January 22–24, 1990, in Washington, D.C., which states “The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an eight-hour day)” (von Gierke 1990; parenthetical wording added for clarification). At the International Congress (1988) on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss; and even above these criteria, results regarding such health effects were ambiguous.

Consequently, it can be concluded that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place.

Although these findings were directed specifically at noise effects in the work place, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous, at best, and often contradictory. Yet, even those studies which purport to find such health effects use time-average noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two University of California at Los Angeles researchers found a relation between aircraft noise levels under the approach path to Los Angeles International Airport and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the “noise-exposed” population (Meecham and Shaw 1979). Nevertheless, three other University of California at Los Angeles professors analyzed those same data and found no relation between noise exposure and mortality rates (Frerichs *et al.* 1980).

As a second example, two other University of California at Los Angeles researchers used this same population near Los Angeles International Airport to show a higher rate of birth defects during the period of 1970 to 1972 when compared with a control group residing away from the airport (Jones and Tauscher 1978). Based on this report, a separate group at the United States Centers for Disease Control performed a more thorough study of populations near Atlanta's Hartsfield International Airport for 1970 to 1972 and found no relation in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Edmonds *et al.* 1979).

A recent review of health effects, prepared by a Committee of the Health Council of The Netherlands (Committee of the Health Council of the Netherlands 1996), analyzed currently available published information on this topic. The committee concluded that the threshold for possible long-term health effects was a 16-hour (6:00 a.m. to 10:00 p.m.)  $L_{eq}$  of 70 dB. Projecting this to 24 hours and applying the 10 dB nighttime penalty used with DNL, this corresponds to DNL of about 75 dB. The study also affirmed the risk threshold for hearing loss, as discussed earlier.

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB. The potential for noise to affect physiological health, such as the cardiovascular system, has been speculated; however, no unequivocal evidence exists to support such claims (Harris 1997). Conclusions drawn from a review of health effect studies involving military low-altitude flight noise with its unusually high maximum levels and rapid rise in sound level have shown no increase in cardiovascular disease (Schwarze and Thompson 1993). Additional claims that are unsupported include flyover noise producing increased mortality rates and increases in cardiovascular death, aggravation of post-traumatic stress disorder, increased stress, increases in admissions to mental hospitals, and adverse affects on pregnant women and the unborn fetus (Harris 1997).

## **2.3 ANNOYANCE**

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the USEPA as any negative subjective reaction on the part of an individual or group (USEPA 1974). As noted in the discussion of DNL above, community annoyance is best measured by that metric.

Because the USEPA Levels Document (USEPA 1974) identified DNL of 55 dB as “. . . requisite to protect public health and welfare with an adequate margin of safety,” it is commonly assumed that 55 dB should be adopted as a criterion for community noise analysis. From a noise exposure perspective, that would be an ideal selection. However, financial and technical resources are generally not available to achieve that goal. Most agencies have identified DNL of 65 dB as a criterion which protects those most impacted by noise, and which can often be achieved on a practical basis (Federal Interagency Committee on Noise 1992). This corresponds to about 12 percent of the exposed population being highly annoyed.

Although DNL of 65 dB is widely used as a benchmark for significant noise impact, and is often an acceptable compromise, it is not a statutory limit, and it is appropriate to consider other thresholds in particular cases.

In this analysis, no specific threshold is used. The noise in the affected environment is evaluated on the basis of the information presented in this appendix and in the body of the environmental analysis.

Community annoyance from sonic booms is based on CDNL, as discussed in Section 1.3. These effects are implicitly included in the “equivalent annoyance” CDNL values in Table I-3, since those were developed from actual community noise impact.

## **2.4 SPEECH INTERFERENCE**

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities in the home, such as radio or television listening, telephone use, or family conversation, gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that the use of the SEL metric will measure speech interference successfully, and that a SEL exceeding 65 dB will begin to interfere with speech communication.

## **2.5 SLEEP INTERFERENCE**

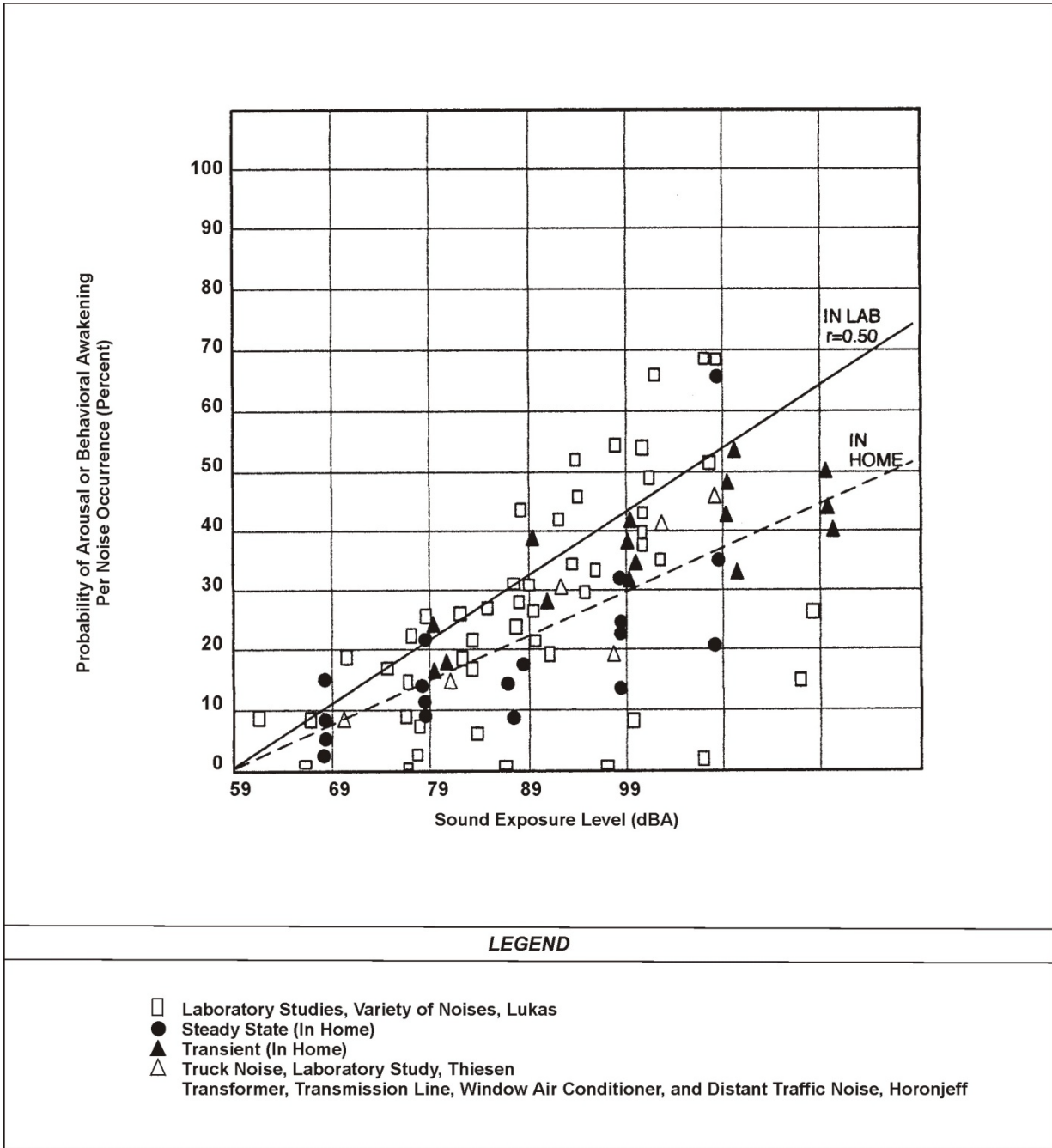
Sleep interference is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

Sleep interference may be measured in either of two ways. "Arousal" represents actual awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without actual awakening. In general, arousal requires a somewhat higher noise level than does a change in sleep stage.

An analysis sponsored by the Air Force summarized 21 published studies concerning the effects of noise on sleep (Pearsons *et al.* 1989). The analysis concluded that a lack of reliable in-home studies, combined with large differences among the results from the various laboratory studies, did not permit development of an acceptably accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced. None of the laboratory studies were of sufficiently long duration to determine any effects of habituation, such as that which would occur under normal community conditions. A recent extensive study of sleep interference in people's own homes (Ollerhead *et al.* 1992) showed very little disturbance from aircraft noise.

There is some controversy associated with the recent studies, so a conservative approach should be taken in judging sleep interference. Based on older data, the USEPA identified an indoor DNL of 45 dB as necessary to protect against sleep interference (USEPA 1974). Assuming a very conservative structural noise insulation of 20 dB for typical dwelling units, this corresponds to an outdoor DNL of 65 dB as minimizing sleep interference.

A 1984 publication reviewed the probability of arousal or behavioral awakening in terms of SEL (Kryter 1984). Figure I-4, extracted from Figure 10.37 of Kryter (1984), indicates that an indoor SEL of 65 dB or lower should awaken less than 5 percent of those exposed. These results do not include any habituation over time by sleeping subjects. Nevertheless, this provides a reasonable guideline for assessing sleep interference and corresponds to similar guidance for speech interference, as noted above.



**Figure I-4. Probability of Arousal or Behavioral Awakening in Terms of Sound Exposure Level**

## **2.6 NOISE EFFECTS ON DOMESTIC ANIMALS AND WILDLIFE**

Animal species differ greatly in their responses to noise. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food, and communicate with and attract other members of their species. Aircraft noise may mask or interfere with these functions. Secondary effects may include nonauditory effects similar to those exhibited by humans: stress, hypertension, and other nervous disorders. Tertiary effects may include interference with mating and resultant population declines.

## **2.7 NOISE EFFECTS ON STRUCTURES**

### ***SUBSONIC AIRCRAFT NOISE***

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at sound levels above 130 dB, there is the possibility of the excitation of structural component resonance. While certain frequencies (such as 30 Hz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (National Research Council/National Academy of Sciences 1977).

A study directed specifically at low-altitude, high-speed aircraft showed that there is little probability of structural damage from such operations (Sutherland 1989). One finding in that study is that sound levels at damaging frequencies (e.g., 30 Hz for window breakage or 15 to 25 Hz for whole-house response) are rarely above 130 dB.

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or “rattle,” of objects within the dwelling, such as hanging pictures, dishes, plaques, and bric-a-brac. Window panes may also vibrate noticeably when exposed to high levels of airborne noise, causing homeowners to fear breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally incompatible with residential land use. Thus assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

### ***SONIC BOOMS***

Sonic booms are commonly associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table I-5 summarizes the threshold of damage that might be expected at various overpressures. There is a large degree of variability in damage experience, and much damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. At 1 psf, the probability of a window breaking ranges from one in a billion (Sutherland 1990) to one in a million (Hershey and Higgins 1976). These damage rates are associated with a combination of boom load and glass condition. At 10 psf, the probability of breakage is between one in a hundred and one in a thousand. Laboratory tests of glass (White 1972) have shown that properly installed window glass will not break at overpressures below 10 psf, even when subjected to repeated booms, but in the real world glass is not in pristine condition.

**Table I-5. Possible Damage to Structures From Sonic Booms**

<i>Sonic Boom Overpressure Nominal (psf)</i>	<i>Type of Damage</i>	<i>Item Affected</i>
0.5 - 2	Plaster	Fine cracks; extension of existing cracks; more in ceilings; over door frames; between some plaster boards.
	Glass	Rarely shattered; either partial or extension of existing.
	Roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.
	Other	Dust falls in chimneys.
2 - 4	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 - 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.
	Walls (in)	Inside ("party") walls known to move at 10 psf.
Greater than 10	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plaster boards displaced by nail popping.
	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; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

Source: Haber and Nakaki 1989

Damage to plaster occurs at similar ranges to glass damage. Plaster has a compounding issue in that it will often crack due to shrinkage while curing, or from stresses as a structure settles, even in the absence of outside loads. Sonic boom damage to plaster often occurs when internal stresses are high from these factors.

Some degree of damage to glass and plaster should thus be expected whenever there are sonic booms, but usually at the low rates noted above. In general, structural damage from sonic booms should be expected only for overpressures above 10 psf.

## **2.8 NOISE EFFECTS ON TERRAIN**

### ***SUBSONIC AIRCRAFT NOISE***

Members of the public often believe that noise from low-flying aircraft can cause avalanches or landslides by disturbing fragile soil or snow structures in mountainous areas. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

### ***SONIC BOOMS***

In contrast to subsonic noise, sonic booms are considered to be a potential trigger for snow avalanches. Avalanches are highly dependent on the physical status of the snow, and do occur spontaneously. They can be triggered by minor disturbances, and there are documented accounts of sonic booms triggering avalanches. Switzerland routinely restricts supersonic flight during avalanche season.

Landslides are not an issue for sonic booms. There was one anecdotal report of a minor landslide from a sonic boom generated by the Space Shuttle during landing, but there is no credible mechanism or consistent pattern of reports.

## **2.9 NOISE EFFECTS ON HISTORICAL AND ARCHAEOLOGICAL SITES**

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may affect such sites more severely than newer, modern structures. Again, there are few scientific studies of such effects to provide guidance for their assessment.

One study involved the measurements of sound levels and structural vibration levels in a superbly restored plantation house, originally built in 1795, and now situated approximately 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport. These measurements were made in connection with the proposed scheduled operation of the supersonic Concorde airplane at Dulles (Wesler 1977). There was special concern for the building's windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning within the building itself.

As noted above for the noise effects of noise-induced vibrations on normal structures, assessments of noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites.

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## **3.0 NOISE MODELING**

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### **3.1 SUBSONIC AIRCRAFT NOISE**

An aircraft in subsonic flight generally emits noise from two sources: the engines and flow noise around the airframe. Noise generation mechanisms are complex and, in practical models, the noise sources must be based on measured data. The Air Force has developed a series of computer models and aircraft noise databases for this purpose. The models include NOISEMAP (Moulton 1992) for noise around airbases, and MR\_NMAP (Lucas and Calamia 1996) for use in MOAs, ranges, and low-level training routes. These models use the NOISEFILE database developed by the Air Force. NOISEFILE data includes SEL and  $L_{Amax}$  as a function of speed and power setting for aircraft in straight flight.

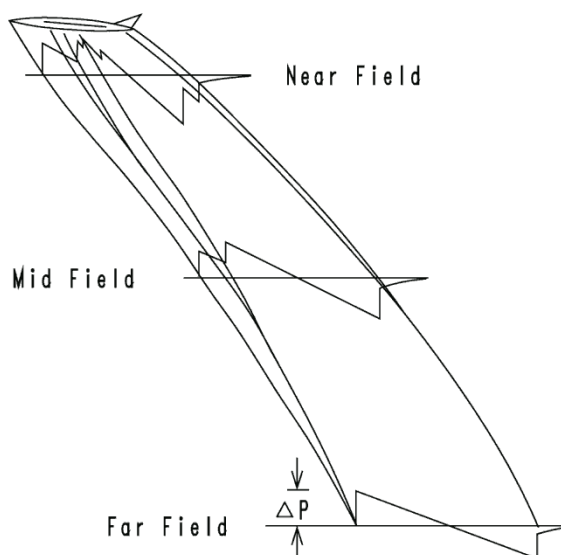


Noise from an individual aircraft is a time-varying continuous sound. It is first audible as the aircraft approaches, increases to a maximum when the aircraft is near its closest point, then diminishes as it departs. The noise depends on the speed and power setting of the aircraft and its trajectory. The models noted above divide the trajectory into segments whose noise can be computed from the data in NOISEFILE. The contributions from these segments are summed.

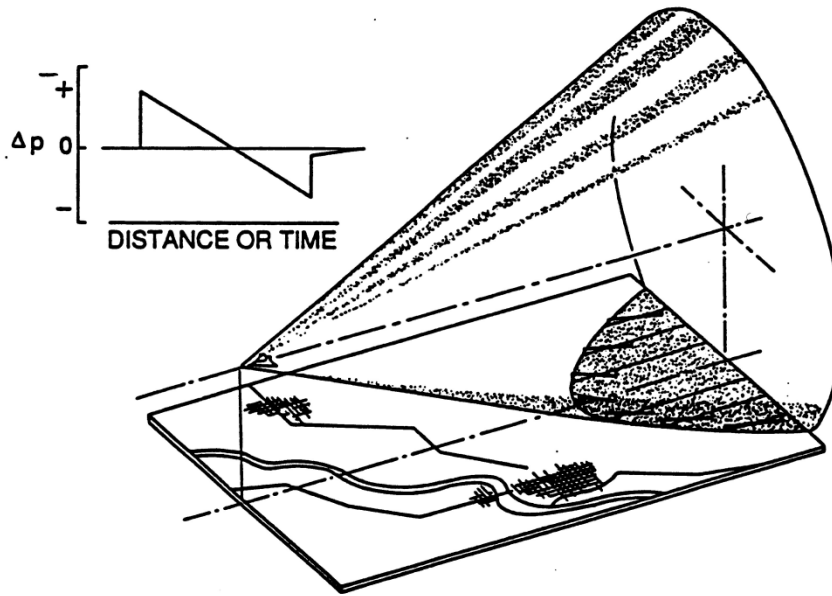
MR\_NMAP was used to compute noise levels in the airspace. The primary noise metric computed by MR\_NMAP was  $L_{dnmr}$  averaged over each airspace. Supporting routines from NOISEMAP were used to calculate SEL and  $L_{Amax}$  for various flight altitudes and lateral offsets from a ground receiver position.

## 3.2 SONIC BOOMS

When an aircraft moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the aircraft is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. When heard at the ground, a sonic boom consists of two shock waves (one associated with the forward part of the aircraft, the other with the rear part) of approximately equal strength and (for fighter aircraft) separated by 100 to 200 milliseconds. When plotted, this pair of shock waves and the expanding flow between them have the appearance of a capital letter "N," so a sonic boom pressure wave is usually called an "N-wave." An N-wave has a characteristic "bang-bang" sound that can be startling. Figure I-5 shows the generation and evolution of a sonic boom N-wave under the aircraft. Figure I-6 shows the sonic boom pattern for an aircraft in steady supersonic flight. The boom forms a cone that is said to sweep out a "carpet" under the flight track.

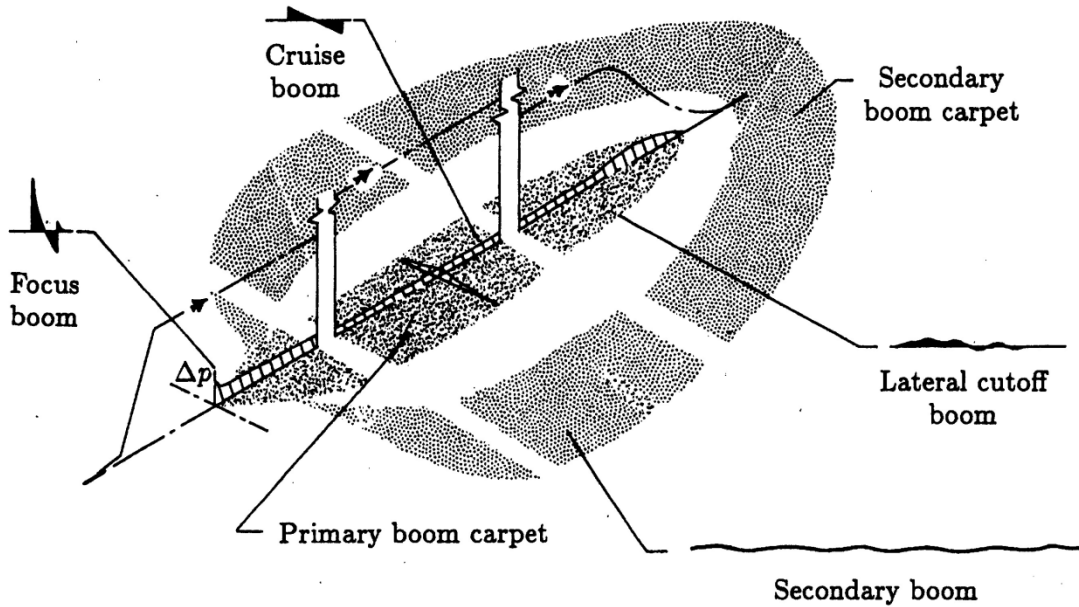


**Figure I-5. Sonic Boom Generation and Evolution to N-Wave**



**Figure I-6. Sonic Boom Carpet in Steady Flight**

The complete ground pattern of a sonic boom depends on the size, shape, speed, and trajectory of the aircraft. Even for a nominally steady mission, the aircraft must accelerate to supersonic speed at the start, decelerate back to subsonic speed at the end, and usually change altitude. Figure I-7 illustrates the complexity of a nominal full mission.



**Figure I-7. Complex Sonic Boom Pattern for Full Mission**

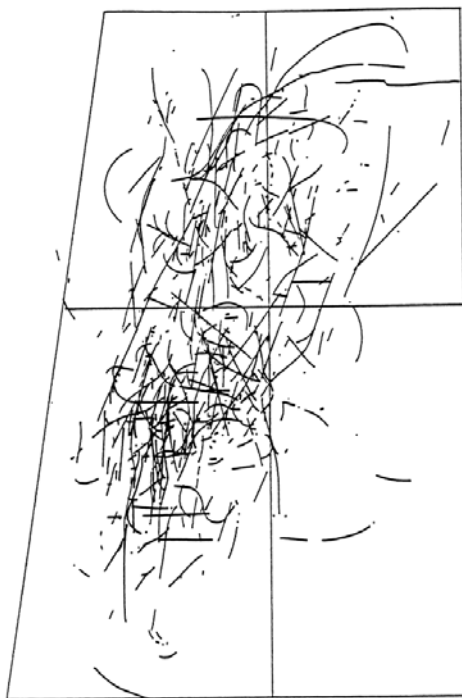
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The Air Force's PCBoom4 computer program (Plotkin and Grandi 2002) can be used to compute the complete sonic boom footprint for a given single event, accounting for details of a particular maneuver.

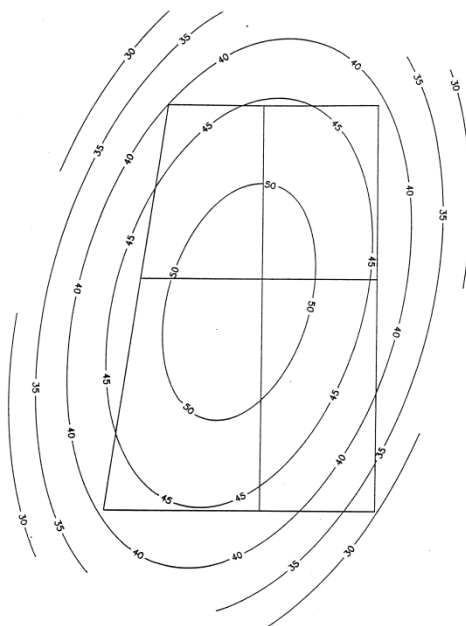
Supersonic operations for the proposed action and alternatives are, however, associated with air combat training, which cannot be described in the deterministic manner that PCBoom4 requires. Supersonic events occur as aircraft approach an engagement, break at the end, and maneuver for advantage during the engagement. Long time cumulative sonic boom exposure, CDNL, is meaningful for this kind of environment.

Long-term sonic boom measurement projects have been conducted in four supersonic air combat training airspaces: White Sands, New Mexico (Plotkin *et al.* 1989); the eastern portion of the Goldwater Range, Arizona (Plotkin *et al.* 1992); the Elgin MOA at Nellis AFB, Nevada (Frampton *et al.* 1993); and the western portion of the Goldwater Range (Page *et al.* 1994). These studies included analysis of schedule and air combat maneuvering instrumentation data and supported development of the 1992 BOOMAP model (Plotkin *et al.* 1992). The current version of BOOMAP (Frampton *et al.* 1993; Plotkin 1996) incorporates results from all four studies. Because BOOMAP is directly based on long-term measurements, it implicitly accounts for such variables as maneuvers, statistical variations in operations, atmosphere effects, and other factors.

Figure I-8 shows a sample of supersonic flight tracks measured in the air combat training airspace at White Sands (Plotkin *et al.* 1989). The tracks fall into an elliptical pattern aligned with preferred engagement directions in the airspace. Figure I-9 shows the CDNL contours that were fit to six months of measured booms in that airspace. The subsequent measurement programs refined the fit, and demonstrated that the elliptical maneuver area is related to the size and shape of the airspace (Frampton *et al.* 1993). BOOMAP quantifies the size and shape of CDNL contours, and also numbers of booms per day, in air combat training airspaces. That model was used for prediction of cumulative sonic boom exposure in this analysis.



**Figure I-8. Supersonic Flight Tracks in Supersonic  
Air Combat Training Airspace**



**Figure I-9. Elliptical CDNL Contours in Supersonic Air Combat Training Airspace**

## **4.0 DETAILED NOISE ANALYSIS RESULTS**

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Table I-6 expands on Table 4.2-5 in the body of the document. The frequency of events exceeding stated thresholds under baseline conditions is compared to the frequency of events under the proposed Modified Alternative A. In addition, a 95 dB threshold is included to show the frequency of overflights at higher noise levels.

Table I-7 compares the number of days between noise events under baseline conditions and under the proposed Modified Alternative A. Under the proposed Modified Alternative A, overflights of 65 dB SEL would occur as frequently as every other day, to once every 19 days. Overflights of 105 dB SEL would occur rarely under the proposed Modified Alternative A.

Table I-8 expands on Table 4.2-7 in the Chapter 4 of the document. The frequency of events under baseline conditions is compared to the frequency of events under the proposed Modified Alternative A using the Maximum Sound Level ( $L_{max}$ ) noise metric. The  $L_{max}$  noise metric is used to further clarify effects of noise on different types of community annoyance.

Table I-9 compares the number of days between noise events under baseline conditions and under the proposed Modified Alternative A using the  $L_{max}$  noise metric.

**Table I-6. Average Frequency of Military Aircraft Noise Events at Varying Noise Thresholds (in dB SEL) at Selected Representative Noise-Sensitive Locations<sup>1</sup> Under Modified Alternative A (Page 1 of 2)**

ID#	General Description	Baseline Airspace	Baseline Number of Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL		65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL
1	Inyan Kara Mountain	Gateway ATCAA	0.44607	0.14885	0.00000	0.00000	Gateway West ATCAA	0.26183	0.14830	0.00000	0.00000
2	Devils Tower National Monument <sup>2</sup>	Gateway ATCAA	0.44607	0.14885	0.00000	0.00000	Gateway West ATCAA	0.47862	0.20488	0.00000	0.00000
3	Little Bighorn Battlefield National Monument <sup>3</sup>	None	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	0.19267	0.11854	0.02837	0.00000
4	Bear Butte	None	n/a	n/a	n/a	n/a	Gateway West ATCAA	0.26183	0.14830	0.00000	0.00000
5	Thunder Basin National Forest (northern section)	None	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	0.45839	0.23939	0.01257	0.00452
6	Thunder Basin National Forest (southern section)	Gateway ATCAA	0.44607	0.14885	0.00000	0.00000	Gateway West ATCAA	0.26183	0.14830	0.00000	0.00000
7	Black Hills National Forest	Gateway ATCAA	0.44607	0.14885	0.00000	0.00000	Gateway West ATCAA	0.26183	0.14830	0.00000	0.00000
8	Custer National Forest (western section)	None	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	1.3000	0.64000	0.25700	0.0040
9	Custer National Forest (central section)	Powder River A	0.63323	0.23886	0.03067	0.00000	PR-2 MOA/ATCAA	0.45829	0.23939	0.01257	0.00452
10	Custer National Forest (southeastern section)	none	n/a	n/a	n/a	n/a	Gateway West ATCAA	0.26183	0.14830	0.00000	0.00000
11	Little Missouri National Grassland	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	0.30563	0.15976	0.01242	0.00342
12	Grand River National Grassland	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.36685	0.19403	0.01838	0.00000
13	Crow Native American Reservation (Crow Agency, MT)	none	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	0.12065	0.06652	0.00601	0.00239
14	Northern Cheyenne Native American Reservation (Lame Deer, MT)	none	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	0.30000	0.19000	0.00100	0.00000

**Table I-6. Average Frequency of Military Aircraft Noise Events at Varying Noise Thresholds (in dB SEL) at Selected Representative Noise-Sensitive Locations<sup>1</sup> Under Modified Alternative A (Page 2 of 2)**

ID#	General Description	Baseline Airspace	Baseline Number of Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL		65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL
15	Standing Rock Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.36685	0.19403	0.01838	0.00000
16	Cheyenne River Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.36685	0.19403	0.01838	0.00000
17	Hardin, MT	none	n/a	n/a	n/a	n/a	PR-1A MOA/ATCAA	0.12480	0.05755	0.00965	0.00388
18	Colstrip, MT	none	n/a	n/a	n/a	n/a	PR-1B MOA/ATCAA	0.48180	0.26711	0.02767	0.01172
19	Broadus, MT <sup>4</sup>	Powder River A MOA	0.73111	0.29312	0.05655	0.02117	PR-2 MOA/ATCAA	0.55493	0.30235	0.03281	0.013890
20	Ekalaka, MT	none	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	0.62127	0.33747	0.03712	0.01389
21	Baker, MT	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	0.30171	0.15834	0.01120	0.00158
22	Elgin, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.36685	0.19403	0.01838	0.00000
23	Bowman, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.36685	0.19403	0.01838	0.00000
24	Bison, SD	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.36685	0.19403	0.01838	0.00000
25	Buffalo, SD	none	n/a	n/a	n/a	n/a	Gap B MOA/ATCAA	0.05334	0.02723	0.00161	0.00061
26	Sundance, WY	Gateway ATCAA	0.44607	0.14885	0.00000	0.00000	Gateway West ATCAA	0.26183	0.14830	0.00000	0.00000
27	Belle Fourche, SD	Gateway ATCAA	0.44607	0.14885	0.00000	0.00000	Gateway West ATCAA	0.26183	0.14830	0.00000	0.00000

## Notes:

1. Because several of the listed noise-sensitive areas are very large, locations were selected from within the designated areas that are near the center of proposed airspace units.
2. Devils Tower National Monument published aircraft avoidance area is 5 NM horizontally and 18,000 feet AGL.
3. Little Bighorn Battlefield National Monument published aircraft avoidance area is 0.75 NM horizontally and 2,000 feet AGL.
4. Broadus, MT published aircraft avoidance area is 3 NM horizontally and 1,500 feet AGL.

**Table I-7. Number of Days between Events at Varying Sound Exposure Levels (SEL) Thresholds (Page 1 of 2)**

ID #	General Description	Baseline Airspace	Baseline # Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL		65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL
1	Inyan Kara Mountain	Gateway ATCAA	2.24	6.72	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	3.82	6.74	rare <sup>1</sup>	rare <sup>1</sup>
2	Devils Tower National Monument	Gateway ATCAA	2.24	6.72	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	2.09	4.88	rare <sup>1</sup>	rare <sup>1</sup>
3	Little Bighorn Battlefield National Monument	None	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	5.19	8.44	35.25	rare <sup>1</sup>
4	Bear Butte	None	n/a	n/a	n/a	n/a	Gateway West ATCAA	3.82	6.74	rare <sup>1</sup>	rare <sup>1</sup>
5	Thunder Basin National Forest (northern section)	None	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	2.18	4.18	79.57	221.15
6	Thunder Basin National Forest (southern section)	Gateway ATCAA	2.24	6.72	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	3.82	6.74	rare <sup>1</sup>	rare <sup>1</sup>
7	Black Hills National Forest	Gateway ATCAA	2.24	6.72	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	3.82	6.74	rare <sup>1</sup>	rare <sup>1</sup>
8	Custer National Forest (western section)	None	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	0.80	1.60	3.90	243.30
9	Custer National Forest (central section)	Powder River A	1.58	4.19	32.61	rare <sup>1</sup>	PR-2 MOA/ATCAA	2.18	4.18	79.57	221.15
10	Custer National Forest (southeastern section)	none	n/a	n/a	n/a	n/a	Gateway West ATCAA	3.82	6.74	rare <sup>1</sup>	rare <sup>1</sup>
11	Little Missouri National Grassland	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	3.27	6.26	80.52	291.99
12	Grand River National Grassland	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	2.73	5.15	54.41	rare <sup>1</sup>
13	Crow Native American Reservation (Crow Agency, MT)	none	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	8.29	15.03	166.39	418.52

**Table I-7. Number of Days between Events at Varying Sound Exposure Levels (SEL) Thresholds (Page 2 of 2)**

ID #	General Description	Baseline Airspace	Baseline # Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL		65 dB SEL	75 dB SEL	85 dB SEL	95 dB SEL
14	Northern Cheyenne Native American Reservation (Lame Deer, MT)	none	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	3.3	5.3	961.5	rare <sup>1</sup>
15	Standing Rock Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	2.73	5.15	54.41	rare <sup>1</sup>
16	Cheyenne River Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	2.73	5.15	54.41	rare <sup>1</sup>
17	Hardin, MT	none	n/a	n/a	n/a	n/a	PR-1A MOA/ATCAA	8.01	17.38	103.63	258.05
18	Colstrip, MT	none	n/a	n/a	n/a	n/a	PR-1B MOA/ATCAA	2.08	3.74	36.14	85.32
19	Broadus, MT	Powder River A MOA	1.37	3.41	17.68	47.23	PR-2 MOA/ATCAA	1.80	3.31	30.48	71.97
20	Ekalaka, MT	none	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	1.16	2.96	26.94	71.97
21	Baker, MT	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	3.31	6.32	89.32	631.71
22	Elgin, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	2.73	5.15	54.41	rare <sup>1</sup>
23	Bowman, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	2.73	5.15	54.41	rare <sup>1</sup>
24	Bison, SD	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	2.73	5.15	54.41	rare <sup>1</sup>
25	Buffalo, SD	none	n/a	n/a	n/a	n/a	Gap B MOA/ATCAA	18.75	36.73	619.77	1,630.26
26	Sundance, WY	Gateway ATCAA	2.24	6.72	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	3.82	6.74	rare <sup>1</sup>	rare <sup>1</sup>
27	Belle Fourche, SD	Gateway ATCAA	2.24	6.72	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	3.82	6.74	rare <sup>1</sup>	rare <sup>1</sup>

1. Overflight occurrences described as rare may happen less frequently than once every 100,000 days.



**Table I-8. Average Frequency of Military Aircraft Noise Events at Varying Noise Thresholds (in dB L<sub>max</sub>) at Selected Representative Noise-Sensitive Locations<sup>1</sup> Under Modified Alternative A (Page 1 of 2)**

ID#	General Description	Baseline Airspace	Baseline Number of Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB L <sub>max</sub>	75 dB L <sub>max</sub>	85 dB L <sub>max</sub>	95 dB L <sub>max</sub>		65 dB L <sub>max</sub>	75 dB L <sub>max</sub>	85 dB L <sub>max</sub>	95 dB L <sub>max</sub>
1	Inyan Kara Mountain	Gateway ATCAA	0.00000	0.00000	0.00000	0.00000	Gateway West ATCAA	0.10825	0.00000	0.00000	0.00000
2	Devils Tower National Monument <sup>2</sup>	Gateway ATCAA	0.00000	0.00000	0.00000	0.00000	Gateway West ATCAA	0.00000	0.00000	0.00000	0.00000
3	Little Bighorn Battlefield National Monument <sup>3</sup>	None	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	0.10392	0.10336	0.00770	0.00000
4	Bear Butte	None	n/a	n/a	n/a	n/a	Gateway West ATCAA	0.10825	0.00000	0.00000	0.00000
5	Thunder Basin National Forest (northern section)	None	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	0.19139	0.01821	0.00537	0.00205
6	Thunder Basin National Forest (southern section)	Gateway ATCAA	0.00000	0.00000	0.00000	0.00000	Gateway West ATCAA	0.10825	0.00000	0.00000	0.00000
7	Black Hills National Forest	Gateway ATCAA	0.00000	0.00000	0.00000	0.00000	Gateway West ATCAA	0.10825	0.00000	0.00000	0.00000
8	Custer National Forest (western section)	None	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	0.60000	0.24000	0.00500	0.00190
9	Custer National Forest (central section)	Powder River A	0.10896	0.05541	0.01528	0.00637	PR-2 MOA/ATCAA	0.19139	0.01821	0.00537	0.00205
10	Custer National Forest (southeastern section)	none	n/a	n/a	n/a	n/a	Gateway West ATCAA	0.10825	0.00000	0.00000	0.00000
11	Little Missouri National Grassland	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	0.13011	0.01705	0.00399	0.00155
12	Grand River National Grassland	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.14704	0.02042	0.00000	0.00000
13	Crow Native American Reservation (Crow Agency, MT)	none	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	0.05839	0.00892	0.00265	0.00103
14	Northern Cheyenne Native American Reservation (Lame Deer, MT)	none	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	0.10000	0.00100	0.00000	0.00000

**Table I-8. Average Frequency of Military Aircraft Noise Events at Varying Noise Thresholds (in dB  $L_{max}$ ) at Selected Representative Noise-Sensitive Locations<sup>1</sup> Under Modified Alternative A (Page 2 of 2)**

ID#	General Description	Baseline Airspace	Baseline Number of Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$		65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$
15	Standing Rock Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.14704	0.02042	0.00000	0.00000
16	Cheyenne River Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.14704	0.02042	0.00000	0.00000
17	Hardin, MT	none	n/a	n/a	n/a	n/a	PR-1A MOA/ATCAA	0.05628	0.01440	0.02598	0.00965
18	Colstrip, MT	none	n/a	n/a	n/a	n/a	PR-1B MOA/ATCAA	0.22734	0.03801	0.01653	0.00619
19	Broadus, MT <sup>4</sup>	Powder River A MOA	0.16515	0.07461	0.02878	0.01160	PR-2 MOA/ATCAA	0.25890	0.04558	0.02019	0.00738
20	Ekalaka, MT	none	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	0.29059	0.05145	0.02280	0.00826
21	Baker, MT	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	0.13047	0.01860	0.00297	0.00315
22	Elgin, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.14704	0.02042	0.00000	0.00000
23	Bowman, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.14704	0.02042	0.00000	0.00000
24	Bison, SD	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	0.14704	0.02042	0.00000	0.00000
25	Buffalo, SD	none	n/a	n/a	n/a	n/a	Gap B MOA/ATCAA	0.02278	0.00230	0.00072	0.00027
26	Sundance, WY	Gateway ATCAA	0.00000	0.00000	0.00000	0.00000	Gateway West ATCAA	0.10825	0.00000	0.00000	0.00000
27	Belle Fourche, SD	Gateway ATCAA	0.00000	0.00000	0.00000	0.00000	Gateway West ATCAA	0.10825	0.00000	0.00000	0.00000

Notes:

1. Because several of the listed noise-sensitive areas are very large, locations were selected from within the designated areas that are near the center of proposed airspace units.
2. Devils Tower National Monument published aircraft avoidance area is 5 NM horizontally and 18,000 feet AGL.
3. Little Bighorn Battlefield National Monument published aircraft avoidance area is 0.75 NM horizontally and 2,000 feet AGL.
4. Broadus, MT published aircraft avoidance area is 3 NM horizontally and 1,500 feet AGL.

**Table I-9. Number of Days between Overflight Events at Varying Maximum Sounds Level ( $L_{max}$ ) Thresholds (Page 1 of 3)**

ID #	General Description	Baseline Airspace	Baseline # Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$		65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$
1	Inyan Kara Mountain	Gateway ATCAA	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	9.24	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>
2	Devils Tower National Monument	Gateway ATCAA	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>
3	Little Bighorn Battlefield National Monument	None	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	9.62	9.68	129.95	rare <sup>1</sup>
4	Bear Butte	None	n/a	n/a	n/a	n/a	Gateway West ATCAA	9.24	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>
5	Thunder Basin National Forest (northern section)	None	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	5.22	54.93	186.08	487.04
6	Thunder Basin National Forest (southern section)	Gateway ATCAA	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	9.24	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>
7	Black Hills National Forest	Gateway ATCAA	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	9.24	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>
8	Custer National Forest (western section)	None	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	1.70	4.20	209.20	537.60
9	Custer National Forest (central section)	Powder River A	9.18	18.05	65.46	156.93	PR-2 MOA/ATCAA	5.22	54.93	186.08	487.04
10	Custer National Forest (southeastern section)	none	n/a	n/a	n/a	n/a	Gateway West ATCAA	9.24	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>
11	Little Missouri National Grassland	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	7.69	58.65	250.38	646.04

**Table I-9. Number of Days between Overflight Events at Varying Maximum Sounds Level ( $L_{max}$ ) Thresholds (Page 2 of 3)**

ID #	General Description	Baseline Airspace	Baseline # Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$		65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$
12	Grand River National Grassland	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	6.80	48.97	rare <sup>1</sup>	rare <sup>1</sup>
13	Crow Native American Reservation (Crow Agency, MT)	none	n/a	n/a	n/a	n/a	PR-1C MOA/ATCAA	17.13	112.11	377.29	973.99
14	Northern Cheyenne Native American Reservation (Lame Deer, MT)	none	n/a	n/a	n/a	n/a	PR-1D MOA/ATCAA	10.0	869.6	rare <sup>1</sup>	rare <sup>1</sup>
15	Standing Rock Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	6.80	48.97	rare <sup>1</sup>	rare <sup>1</sup>
16	Cheyenne River Native American Reservation	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	6.80	48.97	rare <sup>1</sup>	rare <sup>1</sup>
17	Hardin, MT	none	n/a	n/a	n/a	n/a	PR-1A MOA/ATCAA	17.77	69.44	38.49	103.63
18	Colstrip, MT	none	n/a	n/a	n/a	n/a	PR-1B MOA/ATCAA	4.40	26.31	60.50	161.52
19	Broadus, MT	Powder River A MOA	6.06	13.40	34.75	86.22	PR-2 MOA/ATCAA	3.86	21.94	49.52	135.58
20	Ekalaka, MT	none	n/a	n/a	n/a	n/a	PR-2 MOA/ATCAA	3.44	19.44	43.87	121.08
21	Baker, MT	none	n/a	n/a	n/a	n/a	PR-3 MOA/ATCAA	7.66	53.77	336.92	317.06
22	Elgin, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	6.80	48.97	rare <sup>1</sup>	rare <sup>1</sup>

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**Table I-9. Number of Days between Overflight Events at Varying Maximum Sounds Level ( $L_{max}$ ) Thresholds (Page 3 of 3)**

ID #	General Description	Baseline Airspace	Baseline # Events Per Day Exceeding Threshold in Avoidance Area				Proposed Airspace	Proposed Number of Events Per Day Exceeding Threshold in Avoidance Area			
			65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$		65 dB $L_{max}$	75 dB $L_{max}$	85 dB $L_{max}$	95 dB $L_{max}$
23	Bowman, ND	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	6.80	48.97	rare <sup>1</sup>	rare <sup>1</sup>
24	Bison, SD	none	n/a	n/a	n/a	n/a	PR-4 MOA/ATCAA	6.80	48.97	rare <sup>1</sup>	rare <sup>1</sup>
25	Buffalo, SD	none	n/a	n/a	n/a	n/a	Gap B MOA/ATCAA	43.90	434.54	1,398.21	3,665.69
26	Sundance, WY	Gateway ATCAA	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	9.24	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>
27	Belle Fourche, SD	Gateway ATCAA	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>	Gateway West ATCAA	9.24	rare <sup>1</sup>	rare <sup>1</sup>	rare <sup>1</sup>

1. Overflight occurrences described as rare may happen less frequently than once every 100,000 days.
2. In using MRNMAP2 to calculate time-average sound levels for airspaces, the reliability of the results varies at lower levels (below 55 dB). This arises from the increasing variability of individual aircraft sound levels at the longer distances due to atmospheric effects on sound propagation and to the presence of other sources of noise. Also, when flight activity is infrequent, the time-averaged sound levels are generated by only a few individual aircraft noise events, which may not be statistically representative of the given aircraft modeled. These infrequent operations modeled in MRNMAP2 may result in frequency anomalies at some noise level thresholds.

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***Final  
November 2014***

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*Final*  
*November 2014*

***APPENDIX J***  
***OBSTRUCTION MARKING AND LIGHTING***

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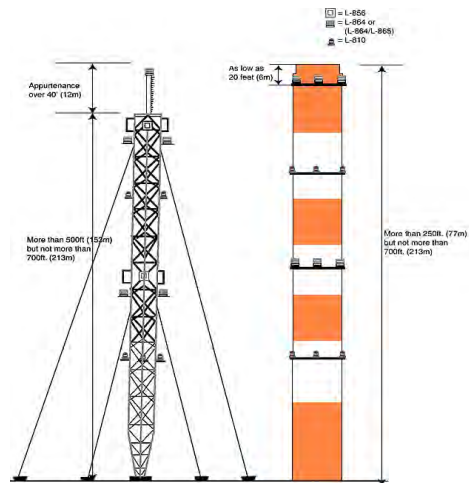
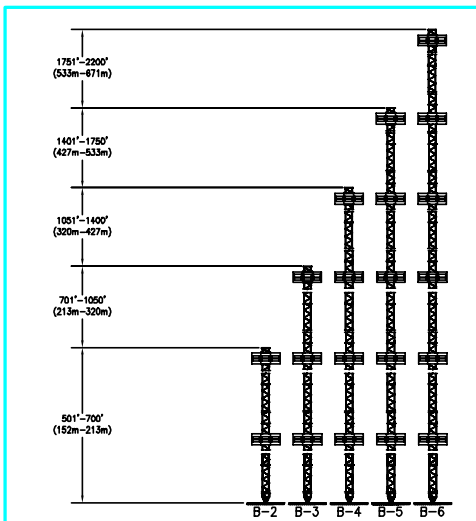
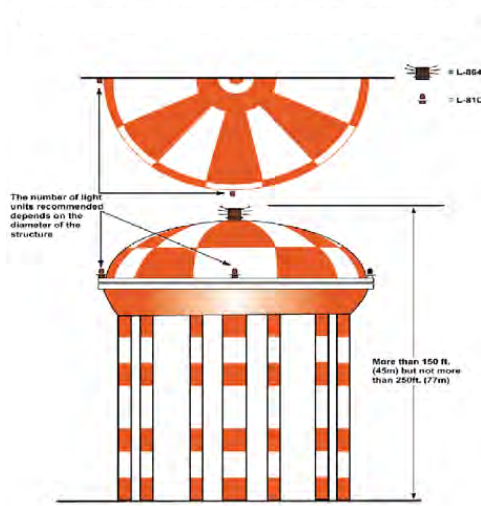


U.S. Department  
of Transportation  
Federal Aviation  
Administration

# ADVISORY CIRCULAR

AC 70/7460-1K

## Obstruction Marking and Lighting



Effective: 2/1/07

Initiated by: System Operations Services

*Final  
November 2014*

**Subject:** CHANGE 2 TO OBSTRUCTION  
MARKING AND LIGHTING

**Date:** 2/1/07  
**Initiated by:** AJR-33

**AC No.:** 70/7460-1K  
**Change:** 2

1. PURPOSE. This change amends the Federal Aviation Administration’s standards for marking and lighting structures to promote aviation safety. The change number and date of the change material are located at the top of the page.
2. EFFECTIVE DATE. This change is effective February 1, 2007.
3. EXPLANATION OF CHANGES.
  - a. Table of Contents. Change pages i through iii.
  - b. Page 1. Paragraph 1. **Reporting Requirements**. Incorporated the word “Title” in reference to the 14 Code of Federal Regulations (14 CFR part 77). FAA Regional Air Traffic Division office to read Obstruction Evaluation service (OES). FAA website to read <http://oeaaa.faa.gov>.
  - c. Page 1. Paragraph 4. **Supplemental Notice Requirement** (subpart b). FAA Regional Air Traffic Division office to read OES.
  - d. Page 1. Paragraph 5. **Modifications and Deviations** (subpart a). FAA Regional Air Traffic Division office to read OES.
  - e. Page 1. Paragraph 5. **Modifications and Deviations** (subpart c). FAA Regional office to read OES.
  - f. Page 2. Paragraph 5. **Modifications and Deviations** (subpart d). Removed period to create one sentence.
  - g. Page 2. Paragraph 7. **Metric Units**. And to read however.
  - h. Page 3. Paragraph 23. **Light Failure Notification** (subpart b). Nearest to read appropriate. FAA’s website to read web. Website [www.faa.gov/ats/ata/ata400](http://www.faa.gov/ats/ata/ata400) to read <http://www.afss.com>.
  - i. Page 4. Paragraph 24. **Notification of Restoration**. Removed AFSS.
  - j. Page 5. Paragraph 32. **Paint Standards**. Removed a comma after “Since”.
  - k. Page 5. Paragraph 33. **Paint Patterns** (subpart d. **Alternate Bands**). Removed number 6. Number 7 to read number 6.
  - l. Page 9. Paragraph 41. **Standards**. TASC to read OTS. SVC-121.23 to read M-30.

- m. Page 14. Paragraph 55. **Wind Turbine Structures**. Removed. The paragraph numbers that follow have been changed accordingly.
- n. Page 18. Paragraph 65. **Wind Turbine Structures**. Removed. The paragraph numbers that follow have been changed accordingly.
- o. Page 20. Paragraph 77. **Radio and Television Towers and Similar Skeletal Structures**. Excluding to read including.
- p. Page 23. Paragraph 85. **Wind Turbine Structures**. Removed. The paragraph number that follows has been changed accordingly.
- q. Page 33-34. Chapter 13. **Marking and Lighting Wind Turbine Farms**. Added.
- r. Page A1-3. Appendix 1. Verbiage removed under first structure.



Nancy B. Kalinowski

Director, System Operations Airspace and Aeronautical Information Management

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PAGE CONTROL CHART

AC 70/7460-1K CHG 2

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<b>Remove Pages</b>	<b>Dated</b>	<b>Insert Pages</b>	<b>Dated</b>
i through iii	8/1/00	i through iii	1/1/07
1-5	8/1/00	1-5	1/1/07
9	3/1/00	9	1/1/07
14	3/1/00	14	1/1/07
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**CHAPTER 1. ADMINISTRATIVE AND GENERAL PROCEDURES**

**1. REPORTING REQUIREMENTS**

A sponsor proposing any type of construction or alteration of a structure that may affect the National Airspace System (NAS) is required under the provisions of Title 14 Code of Federal Regulations (14 CFR part 77) to notify the FAA by completing the Notice of Proposed Construction or Alteration form (FAA Form 7460-1). The form should be sent to the Obstruction Evaluation service (OES). Copies of FAA Form 7460-1 may be obtained from OES, Airports District Office or FAA Website at <http://oeaaa.faa.gov>.

**2. PRECONSTRUCTION NOTICE**

The notice must be submitted:

a. At least 30 days prior to the date of proposed construction or alteration is to begin.

b. On or before the date an application for a construction permit is filed with the Federal Communications Commission (FCC). (The FCC advises its applicants to file with the FAA well in advance of the 30-day period in order to expedite FCC processing.)

**3. FAA ACKNOWLEDGEMENT**

The FAA will acknowledge, in writing, receipt of each FAA Form 7460-1 notice received.

**4. SUPPLEMENTAL NOTICE REQUIREMENT**

a. If required, the FAA will include a FAA Form 7460-2, Notice of Actual Construction or Alteration, with a determination.

b. FAA Form 7460-2 Part 1 is to be completed and sent to the FAA at least 48 hours prior to starting the actual construction or alteration of a structure. Additionally, Part 2 shall be submitted no later than 5 days after the structure has reached its greatest height. The form should be sent to the OES.

c. In addition, supplemental notice shall be submitted upon abandonment of construction.

d. Letters are acceptable in cases where the construction/alteration is temporary or a proposal is abandoned. This notification process is designed to permit the FAA the necessary time to change affected procedures and/or minimum flight altitudes, and to otherwise alert airmen of the structure's presence.

*Note-*  
NOTIFICATION AS REQUIRED IN THE DETERMINATION IS  
CRITICAL TO AVIATION SAFETY.

**5. MODIFICATIONS AND DEVIATIONS**

a. Requests for modification or deviation from the standards outlined in this AC must be submitted to the OES. The sponsor is responsible for adhering to approved marking and/or lighting limitations, and/or recommendations given, and should notify the FAA and FCC (for those structures regulated by the FCC) prior to removal of marking and/or lighting. A request received after a determination is issued may require a new study and could result in a new determination.

b. *Modifications.* Modifications will be based on whether or not they impact aviation safety. Examples of modifications that may be considered:

1. *Marking and/or Lighting Only a Portion of an Object.* The object may be so located with respect to other objects or terrain that only a portion of it needs to be marked or lighted.

2. *No Marking and/or Lighting.* The object may be so located with respect to other objects or terrain, removed from the general flow of air traffic, or may be so conspicuous by its shape, size, or color that marking or lighting would serve no useful purpose.

3. *Voluntary Marking and/or Lighting.* The object may be so located with respect to other objects or terrain that the sponsor feels increased conspicuity would better serve aviation safety. Sponsors who desire to voluntarily mark and/or light their structure should request the proper marking and/or lighting from the FAA to ensure no aviation safety issues are impacted.

4. *Marking or Lighting an Object in Accordance with the Standards for an Object of Greater Height or Size.* The object may present such an extraordinary hazard potential that higher standards may be recommended for increased conspicuity to ensure the safety to air navigation.

c. *Deviations.* The OES conducts an aeronautical study of the proposed deviation(s) and forwards its recommendation to FAA headquarters in Washington, DC, for final approval. Examples of deviations that may be considered:

1. Colors of objects.
2. Dimensions of color bands or rectangles.
3. Colors/types of lights.
4. Basic signals and intensity of lighting.

5. Night/day lighting combinations.

6. Flash rate.

d. The FAA strongly recommends that owners become familiar with the different types of lighting systems and to specifically request the type of lighting system desired when submitting FAA Form 7460-1. (This request should be noted in "item 2.D" of the FAA form.) Information on these systems can be found in Chapter 12, Table 4 of this AC. While the FAA will make every effort to accommodate the structure sponsor's request, sponsors should also request information from system manufacturers in order to determine which system best meets their needs based on purpose, installation, and maintenance costs.

#### 6. ADDITIONAL NOTIFICATION

Sponsors are reminded that any change to the submitted information on which the FAA has based its determination, including modification, deviation or optional upgrade to white lighting on structures which are regulated by the FCC, must also be filed with the FCC prior to making the change for proper

authorization and annotations of obstruction marking and lighting. These structures will be subject to inspection and enforcement of marking and lighting requirements by the FCC. FCC Forms and Bulletins can be obtained from the FCC's National Call Center at 1-888-CALL-FCC (1-888-225-5322). Upon completion of the actual change, notify the Aeronautical Charting office at:

NOAA/NOS Aeronautical Charting Division Station 5601, N/ACC113 1305 East-West Highway Silver Spring, MD 20910-3233
--------------------------------------------------------------------------------------------------------------------------------

#### 7. METRIC UNITS

To promote an orderly transition to metric units, sponsors should include both English and metric (SI units) dimensions. The metric conversions may not be exact equivalents, however, until there is an official changeover to the metric system, the English dimensions will govern.

---

**CHAPTER 2. GENERAL**

**20. STRUCTURES TO BE MARKED AND LIGHTED**

Any temporary or permanent structure, including all appurtenances, that exceeds an overall height of 200 feet (61m) above ground level (AGL) or exceeds any obstruction standard contained in 14 CFR part 77, should normally be marked and/or lighted. However, an FAA aeronautical study may reveal that the absence of marking and/or lighting will not impair aviation safety. Conversely, the object may present such an extraordinary hazard potential that higher standards may be recommended for increased conspicuity to ensure safety to air navigation. Normally outside commercial lighting is not considered sufficient reason to omit recommended marking and/or lighting. Recommendations on marking and/or lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design. The FAA may also recommend marking and/or lighting a structure that does not exceed 200 (61m) feet AGL or 14 CFR part 77 standards because of its particular location.

**21. GUYED STRUCTURES**

The guys of a 2,000-foot (610m) skeletal tower are anchored from 1,600 feet (488m) to 2,000 feet (610m) from the base of the structure. This places a portion of the guys 1,500 feet (458m) from the tower at a height of between 125 feet (38m) to 500 feet (153m) AGL. 14 CFR part 91, section 119, requires pilots, when operating over other than congested areas, to remain at least 500 feet (153m) from man-made structures. Therefore, the tower must be cleared by 2,000 feet (610m) horizontally to avoid all guy wires. Properly maintained marking and lighting are important for increased conspicuity since the guys of a structure are difficult to see until aircraft are dangerously close.

**22. MARKING AND LIGHTING EQUIPMENT**

Considerable effort and research have been expended in determining the minimum marking and lighting systems or quality of materials that will produce an acceptable level of safety to air navigation. The FAA will recommend the use of only those marking and lighting systems that meet established technical standards. While additional lights may be desirable

to identify an obstruction to air navigation and may, on occasion be recommended, the FAA will recommend minimum standards in the interest of safety, economy, and related concerns. Therefore, to provide an adequate level of safety, obstruction lighting systems should be installed, operated, and maintained in accordance with the recommended standards herein.

**23. LIGHT FAILURE NOTIFICATION**

**a.** Sponsors should keep in mind that conspicuity is achieved only when all recommended lights are working. Partial equipment outages decrease the margin of safety. Any outage should be corrected as soon as possible. Failure of a steady burning side or intermediate light should be corrected as soon as possible, but notification is not required.

**b.** Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to the appropriate flight service station (FSS) so a Notice to Airmen (NOTAM) can be issued. Toll-free numbers for FSS are listed in most telephone books or on the web at <http://www.afss.com>. This report should contain the following information:

1. Name of persons or organizations reporting light failures including any title, address, and telephone number.
2. The type of structure.
3. Location of structure (including latitude and longitude, if known, prominent structures, landmarks, etc.).
4. Height of structure above ground level (AGL)/above mean sea level (AMSL), if known.
5. A return to service date.
6. FCC Antenna Registration Number (for structures that are regulated by the FCC).

*Note-*

*1. When the primary lamp in a double obstruction light fails, and the secondary lamp comes on, no report is required. However, when one of the lamps in an incandescent L-864 flashing red beacon fails, it should be reported.*

*2. After 15 days, the NOTAM is automatically deleted from the system. The sponsor is responsible for calling the nearest FSS to extend the outage date or to report a return to service date.*

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**24. NOTIFICATION OF RESTORATION**

As soon as normal operation is restored, notify the same FSS that received the notification of failure. The FCC advises that noncompliance with notification procedures could subject its sponsor to penalties or monetary forfeitures.

**25. FCC REQUIREMENT**

FCC licensees are required to file an environmental assessment with the Commission when seeking authorization for the use of the high intensity flashing white lighting system on structures located in residential neighborhoods, as defined by the applicable zoning law.

### CHAPTER 3. MARKING GUIDELINES

#### 30. PURPOSE

This chapter provides recommended guidelines to make certain structures conspicuous to pilots during daylight hours. One way of achieving this conspicuity is by painting and/or marking these structures. Recommendations on marking structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

#### 31. PAINT COLORS

Alternate sections of aviation orange and white paint should be used as they provide maximum visibility of an obstruction by contrast in colors.

#### 32. PAINT STANDARDS

The following standards should be followed. To be effective, the paint used should meet specific color requirements when freshly applied to a structure. Since all outdoor paints deteriorate with time and it is not practical to give a maintenance schedule for all climates, surfaces should be repainted when the color changes noticeably or its effectiveness is reduced by scaling, oxidation, chipping, or layers of contamination.

**a. *Materials and Application.*** Quality paint and materials should be selected to provide extra years of service. The paint should be compatible with the surfaces to be painted, including any previous coatings, and suitable for the environmental conditions. Surface preparation and paint application should be in accordance with manufacturer's recommendations.

*Note-*

*In-Service Aviation Orange Color Tolerance Charts are available from private suppliers for determining when repainting is required. The color should be sampled on the upper half of the structure, since weathering is greater there.*

**b. *Surfaces Not Requiring Paint.*** Ladders, decks, and walkways of steel towers and similar structures need not be painted if a smooth surface presents a potential hazard to maintenance personnel. Paint may also be omitted from precision or critical surfaces if it would have an adverse effect on the transmission or radiation characteristics of a signal. However, the overall marking effect of the structure should not be reduced.

**c. *Skeletal Structures.*** Complete all marking/painting prior to or immediately upon

completion of construction. This applies to catenary support structures, radio and television towers, and similar skeletal structures. To be effective, paint should be applied to all inner and outer surfaces of the framework.

#### 33. PAINT PATTERNS

Paint patterns of various types are used to mark structures. The pattern to be used is determined by the size and shape of the structure. The following patterns are recommended.

**a. *Solid Pattern.*** Obstacles should be colored aviation orange if the structure has both horizontal and vertical dimensions not exceeding 10.5 feet (3.2m).

**b. *Checkerboard Pattern.*** Alternating rectangles of aviation orange and white are normally displayed on the following structures:

1. Water, gas, and grain storage tanks.
2. Buildings, as required.

**3.** Large structures exceeding 10.5 feet (3.2m) across having a horizontal dimension that is equal to or greater than the vertical dimension.

**c. *Size of Patterns.*** Sides of the checkerboard pattern should measure not less than 5 feet (1.5m) or more than 20 feet (6m) and should be as nearly square as possible. However, if it is impractical because of the size or shape of a structure, the patterns may have sides less than 5 feet (1.5m). When possible, corner surfaces should be colored orange.

**d. *Alternate Bands.*** Alternate bands of aviation orange and white are normally displayed on the following structures:

1. Communication towers and catenary support structures.
2. Poles.
3. Smokestacks.
4. Skeletal framework of storage tanks and similar structures.
5. Structures which appear narrow from a side view, that are 10.5 feet (3.2m) or more across and the horizontal dimension is less than the vertical dimension.
6. Coaxial cable, conduits, and other cables attached to the face of a tower.

**e. Color Band Characteristics.** Bands for structures of any height should be:

1. Equal in width, provided each band is not less than 1½ feet (0.5m) or more than 100 feet (31m) wide.
2. Perpendicular to the vertical axis with the bands at the top and bottom ends colored orange.
3. An odd number of bands on the structure.
4. Approximately one-seventh the height if the structure is 700 feet (214m) AGL or less. For each additional 200 feet (61m) or fraction thereof, add one (1) additional orange and one (1) additional white band.
5. Equal and in proportion to the structure's height AGL.

**Structure Height to Bandwidth Ratio**

Example: If a Structure is:		
Greater Than	But Not More Than	Band Width
10.5 feet (3.2m)	700 feet (214m)	1/7 of height
701 feet (214m)	900 feet (275m)	1/9 of height
901 feet (275m)	1,100 feet (336m)	1/11 of height
1,100 feet (336m)	1,300 feet (397m)	1/13 of height

*TBL 1*

**f. Structures With a Cover or Roof.** If the structure has a cover or roof, the highest orange band should be continued to cover the entire top of the structure.

**g. Skeletal Structures Atop Buildings.** If a flagpole, skeletal structure, or similar object is erected on top of a building, the combined height of the object and building will determine whether marking is recommended; however, only the height of the object under study determines the width of the color bands.

**h. Partial Marking.** If marking is recommended for only a portion of a structure because of shielding by other objects or terrain, the width of the bands should be determined by the overall height of the structure. A minimum of three bands should be displayed on the upper portion of the structure.

**i. Teardrop Pattern.** Spherical water storage tanks with a single circular standpipe support may be marked in a teardrop-striped pattern. The tank should show alternate stripes of aviation orange and white. The stripes should extend from the top center of the tank to its supporting standpipe. The width of the stripes should be equal, and the width of each stripe at the greatest girth of the tank should not be less than 5 feet (1.5m) nor more than 15 feet (4.6m).

**j. Community Names.** If it is desirable to paint the name of the community on the side of a tank, the stripe pattern may be broken to serve this purpose. This open area should have a maximum height of 3 feet (0.9m).

**k. Exceptions.** Structural designs not conducive to standard markings may be marked as follows:

1. If it is not practical to color the roof of a structure in a checkerboard pattern, it may be colored solid orange.

2. If a spherical structure is not suitable for an exact checkerboard pattern, the shape of the rectangles may be modified to fit the shape of the surface.

3. Storage tanks not suitable for a checkerboard pattern may be colored by alternating bands of aviation orange and white or a limited checkerboard pattern applied to the upper one-third of the structure.

4. The skeletal framework of certain water, gas, and grain storage tanks may be excluded from the checkerboard pattern.

**34. MARKERS**

Markers are used to highlight structures when it is impractical to make them conspicuous by painting. Markers may also be used in addition to aviation orange and white paint when additional conspicuity is necessary for aviation safety. They should be displayed in conspicuous positions on or adjacent to the structures so as to retain the general definition of the structure. They should be recognizable in clear air from a distance of at least 4,000 feet (1219m) and in all directions from which aircraft are likely to approach. Markers should be distinctively shaped, i.e., spherical or cylindrical, so they are not mistaken for items that are used to convey other information. They should be replaced when faded or otherwise deteriorated.



**a. Spherical Markers.** Spherical markers are used to identify overhead wires. Markers may be of another shape, i.e., cylindrical, provided the projected area of such markers will not be less than that presented by a spherical marker.

**1. Size and Color.**

The diameter of the markers used on extensive catenary wires across canyons, lakes, rivers, etc., should be not less than 36 inches (91cm). Smaller 20-inch (51cm) spheres are permitted on less extensive power lines or on power lines below 50 feet (15m) above the ground and within 1,500 feet (458m) of an airport runway end. Each marker should be a solid color such as aviation orange, white, or yellow.

**2. Installations.**

**(a) Spacing.** Markers should be spaced equally along the wire at intervals of approximately 200 feet (61m) or a fraction thereof. Intervals between markers should be less in critical areas near runway ends (i.e., 30 to 50 feet (10m to 15m)). They should be displayed on the highest wire or by another means at the same height as the highest wire. Where there is more than one wire at the highest point, the markers may be installed alternately along each wire if the distance between adjacent markers meets the spacing standard. This method allows the weight and wind loading factors to be distributed.

**(b) Pattern.** An alternating color scheme provides the most conspicuity against all backgrounds. Mark overhead wires by alternating solid colored markers of aviation orange, white, and yellow. Normally, an orange sphere is placed at each end of a line and the spacing is adjusted (not to exceed 200 feet (61m)) to accommodate the rest of the markers. When less than four markers are used, they should all be aviation orange.

**b. Flag Markers.** Flags are used to mark certain structures or objects when it is technically impractical to use spherical markers or painting. Some examples are temporary construction equipment, cranes, derricks, oil and other drilling rigs. Catenaries should use spherical markers.

**1. Minimum Size.** Each side of the flag marker should be at least 2 feet (0.6m) in length.

**2. Color Patterns.** Flags should be colored as follows:

**(a) Solid.** Aviation orange.

**(b) Orange and White.** Arrange two triangular sections, one aviation orange and the other white to form a rectangle.

**(c) Checkerboard.** Flags 3 feet (0.9m) or larger should be a checkerboard pattern of aviation orange and white squares, each 1 foot (0.3m) plus or minus 10 percent.

**3. Shape.** Flags should be rectangular in shape and have stiffeners to keep them from drooping in calm wind.

**4. Display.** Flag markers should be displayed around, on top, or along the highest edge of the obstruction. When flags are used to mark extensive or closely grouped obstructions, they should be displayed approximately 50 feet (15m) apart. The flag stakes should be of such strength and height that they will support the flags above all surrounding ground, structures, and/or objects of natural growth.

**35. UNUSUAL COMPLEXITIES**

The FAA may also recommend appropriate marking in an area where obstructions are so grouped as to present a common obstruction to air navigation.

**36. OMISSION OR ALTERNATIVES TO MARKING**

There are two alternatives to marking. Either alternative requires FAA review and concurrence.

**a. High Intensity Flashing White Lighting Systems.** The high intensity lighting systems are more effective than aviation orange and white paint and therefore can be recommended instead of marking. This is particularly true under certain ambient light conditions involving the position of the sun relative to the direction of flight. When high intensity lighting systems are operated during daytime and twilight, other methods of marking may be omitted. When operated 24 hours a day, other methods of marking and lighting may be omitted.

**b. Medium Intensity Flashing White Lighting Systems.** When medium intensity lighting systems are operated during daytime and twilight on structures 500 feet (153m) AGL or less, other methods of marking may be omitted. When operated 24 hours a day on structures 500 feet (153m) AGL or less, other methods of marking and lighting may be omitted.

*Note-*  
SPONSORS MUST ENSURE THAT ALTERNATIVES TO MARKING ARE COORDINATED WITH THE FCC FOR STRUCTURES UNDER ITS JURISDICTION PRIOR TO MAKING THE CHANGE.

*Final*  
*November 2014*

CHAPTER 4. LIGHTING GUIDELINE

40. PURPOSE

This chapter describes the various obstruction lighting systems used to identify structures that an aeronautical study has determined will require added conspicuity. The lighting standards in this circular are the minimum necessary for aviation safety. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

41. STANDARDS

The standards outlined in this AC are based on the use of light units that meet specified intensities, beam patterns, color, and flash rates as specified in AC 150/5345-43.

These standards may be obtained from:

Department of Transportation OTS Subsequent Distribution Office, M-30 Ardmore East Business Center 3341 Q 75th Avenue Landover, MD 20785
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42. LIGHTING SYSTEMS

Obstruction lighting may be displayed on structures as follows:

**a. Aviation Red Obstruction Lights.** Use flashing beacons and/or steady burning lights during nighttime.

**b. Medium Intensity Flashing White Obstruction Lights.** Medium intensity flashing white obstruction lights may be used during daytime and twilight with automatically selected reduced intensity for nighttime operation. When this system is used on structures 500 feet (153m) AGL or less in height, other methods of marking and lighting the structure may be omitted. Aviation orange and white paint is always required for daytime marking on structures exceeding 500 feet (153m) AGL. This system is not normally recommended on structures 200 feet (61m) AGL or less.

**c. High Intensity Flashing White Obstruction Lights.** Use high intensity flashing white obstruction lights during daytime with automatically selected reduced intensities for twilight and nighttime operations. When this system is used, other methods of marking and lighting the structure may be omitted.

This system should not be recommended on structures 500 feet (153m) AGL or less, unless an FAA aeronautical study shows otherwise.

*Note-*  
All flashing lights on a structure should flash simultaneously except for catenary support structures, which have a distinct sequence flashing between levels.

**d. Dual Lighting.** This system consists of red lights for nighttime and high or medium intensity flashing white lights for daytime and twilight. When a dual lighting system incorporates medium flashing intensity lights on structures 500 feet (153m) or less, or high intensity flashing white lights on structures of any height, other methods of marking the structure may be omitted.

**e. Obstruction Lights During Construction.** As the height of the structure exceeds each level at which permanent obstruction lights would be recommended, two or more lights of the type specified in the determination should be installed at that level. Temporary high or medium intensity flashing white lights, as recommended in the determination, should be operated 24 hours a day until all permanent lights are in operation. In either case, two or more lights should be installed on the uppermost part of the structure any time it exceeds the height of the temporary construction equipment. They may be turned off for periods when they would interfere with construction personnel. If practical, permanent obstruction lights should be installed and operated at each level as construction progresses. The lights should be positioned to ensure that a pilot has an unobstructed view of at least one light at each level.

**f. Obstruction Lights in Urban Areas.** When a structure is located in an urban area where there are numerous other white lights (e.g., streetlights, etc.) red obstruction lights with painting or a medium intensity dual system is recommended. Medium intensity lighting is not normally recommended on structures less than 200 feet (61m).

**g. Temporary Construction Equipment Lighting.** Since there is such a variance in construction cranes, derricks, oil and other drilling rigs, each case should be considered individually. Lights should be installed according to the standards given in Chapters 5, 6, 7, or 8, as they would apply to permanent structures.

#### **43. CATENARY LIGHTING**

Lighted markers are available for increased night conspicuity of high-voltage (69KV or greater) transmission line catenary wires. These markers should be used on transmission line catenary wires near airports, heliports, across rivers, canyons, lakes, etc. The lighted markers should be manufacturer certified as recognizable from a minimum distance of 4,000 feet (1219m) under nighttime conditions, minimum visual flight rules (VFR) conditions or having a minimum intensity of at least 32.5 candela. The lighting unit should emit a steady burning red light. They should be used on the highest energized line. If the lighted markers are installed on a line other than the highest catenary, then markers specified in paragraph 34 should be used in addition to the lighted markers. (The maximum distance between the line energizing the lighted markers and the highest catenary above the lighted marker should be no more than 20 feet (6m).) Markers should be distinctively shaped, i.e., spherical, cylindrical, so they are not mistaken for items that are used to convey other information. They should be visible in all directions from which aircraft are likely to approach. The area in the immediate vicinity of the supporting structure's base should be clear of all items and/or objects of natural growth that could interfere with the line-of-sight between a pilot and the structure's lights. Where a catenary wire crossing requires three or more supporting structures, the inner structures should be equipped with enough light units per level to provide a full coverage.

#### **44. INSPECTION, REPAIR AND MAINTENANCE**

To ensure the proper candela output for fixtures with incandescent lamps, the voltage provided to the lamp filament should not vary more than plus or minus 3 percent of the rated voltage of the lamp. The input voltage should be measured at the lamp socket with the lamp operating during the hours of normal operation. (For strobes, the input voltage of the power supplies should be within 10 percent of rated voltage.) Lamps should be replaced after being operated for not more than 75 percent of their rated life or immediately upon failure. Flashtubes in a light unit should be replaced immediately upon failure, when the peak effective intensity falls below specification limits or when the fixture begins skipping flashes, or at the manufacturer's recommended intervals. Due to the effects of harsh environments, beacon lenses should be visually inspected for ultraviolet damage, cracks, crazing, dirt

build up, etc., to insure that the certified light output has not deteriorated. (See paragraph 23, for reporting requirements in case of failure.)

#### **45. NONSTANDARD LIGHTS**

Moored balloons, chimneys, church steeples, and similar obstructions may be floodlighted by fixed search light projectors installed at three or more equidistant points around the base of each obstruction. The searchlight projectors should provide an average illumination of at least 15 foot-candles over the top one-third of the obstruction.

#### **46. PLACEMENT FACTORS**

The height of the structure AGL determines the number of light levels. The light levels may be adjusted slightly, but not to exceed 10 feet (3m), when necessary to accommodate guy wires and personnel who replace or repair light fixtures. Except for catenary support structures, the following factors should be considered when determining the placement of obstruction lights on a structure.

**a. Red Obstruction Lighting Systems.** The overall height of the structure including all appurtenances such as rods, antennas, obstruction lights, etc., determines the number of light levels.

**b. Medium Intensity Flashing White Obstruction Lighting Systems.** The overall height of the structure including all appurtenances such as rods, antennas, obstruction lights, etc., determines the number of light levels.

**c. High Intensity Flashing White Obstruction Lighting Systems.** The overall height of the main structure including all appurtenances such as rods, antennas, obstruction lights, etc., determines the number of light levels.

**d. Dual Obstruction Lighting Systems.** The overall height of the structure including all appurtenances such as rods, antennas, obstruction lights, etc., is used to determine the number of light levels for a medium intensity white obstruction light/red obstruction dual lighting system. The overall height of the structure including all appurtenances is used to determine the number of light levels for a high intensity white obstruction light/red obstruction dual lighting system.

**e. Adjacent Structures.** The elevation of the tops of adjacent buildings in congested areas may be used as the equivalent of ground level to determine the proper number of light levels required.

f. **Shielded Lights.** If an adjacent object shields any light, horizontal placement of the lights should be adjusted or additional lights should be mounted on that object to retain or contribute to the definition of the obstruction.

**47. MONITORING OBSTRUCTION LIGHTS**

Obstruction lighting systems should be closely monitored by visual or automatic means. It is extremely important to visually inspect obstruction lighting in all operating intensities at least once every 24 hours on systems without automatic monitoring. In the event a structure is not readily accessible for visual observation, a properly maintained automatic monitor should be used. This monitor should be designed to register the malfunction of any light on the obstruction regardless of its position or color. When using remote monitoring devices, the communication status and operational status of the system should be confirmed at least once every 24 hours. The monitor (aural or visual) should be located in an area generally occupied by responsible personnel. In some cases, this may require a remote monitor in an attended location. For each structure, a log should be maintained in which daily operations status of the lighting system is recorded. Beacon

lenses should be replaced if serious cracks, crazing, dirt build up, etc., has occurred.

**48. ICE SHIELDS**

Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units.

**49. DISTRACTION**

a. Where obstruction lights may distract operators of vessels in the proximity of a navigable waterway, the sponsor must coordinate with the Commandant, U.S. Coast Guard, to avoid interference with marine navigation.

b. The address for marine information and coordination is:

Chief, Aids to Navigation Division (OPN) U.S. Coast Guard Headquarters 2100 2nd Street, SW., Rm. 3610 Washington, DC 20593-0001 <i>Telephone: (202) 267-0980</i>
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*Final*  
*November 2014*

**CHAPTER 5. RED OBSTRUCTION LIGHT SYSTEM**

**50. PURPOSE**

Red Obstruction lights are used to increase conspicuity during nighttime. Daytime and twilight marking is required. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

**51. STANDARDS**

The red obstruction lighting system is composed of flashing omnidirectional beacons (L-864) and/or steady burning (L-810) lights. When one or more levels is comprised of flashing beacon lighting, the lights should flash simultaneously.

**a. Single Obstruction Light.** A single (L-810) light may be used when more than one obstruction light is required either vertically or horizontally or where maintenance can be accomplished within a reasonable time.

**1. Top Level.** A single light may be used to identify low structures such as airport ILS buildings and long horizontal structures such as perimeter fences and building roof outlines.

**2. Intermediate Level.** Single lights may be used on skeletal and solid structures when more than one level of lights is installed and there are two or more single lights per level.

**b. Double Obstruction Light.** A double (L-810) light should be installed when used as a top light, at each end of a row of single obstruction lights, and in areas or locations where the failure of a single unit could cause an obstruction to be totally unlighted.

**1. Top Level. Structures 150 feet (46m) AGL or less** should have one or more double lights installed at the highest point and operating simultaneously.

**2. Intermediate Level.** Double lights should be installed at intermediate levels when a malfunction of a single light could create an unsafe condition and in remote areas where maintenance cannot be performed within a reasonable time. Both units may operate simultaneously, or a transfer relay may be used to switch to a spare unit should the active system fail.

**3. Lowest Level.** The lowest level of light units may be installed at a higher elevation than normal on a structure if the surrounding terrain, trees, or adjacent building(s) would obscure the lights. In certain instances, as determined by an FAA aeronautical study, the lowest level of lights may be eliminated.

**52. CONTROL DEVICE**

Red obstruction lights should be operated by a satisfactory control device (e.g., photo cell, timer, etc.) adjusted so the lights will be turned on when the northern sky illuminance reaching a vertical surface falls below a level of 60 foot-candles (645.8 lux) but before reaching a level of 35 foot-candles (367.7 lux). The control device should turn the lights off when the northern sky illuminance rises to a level of not more than 60 foot-candles (645.8 lux). The lights may also remain on continuously. The sensing device should, if practical, face the northern sky in the Northern Hemisphere. (See AC 150/5345-43.)

**53. POLES, TOWERS, AND SIMILAR SKELETAL STRUCTURES**

The following standards apply to radio and television towers, supporting structures for overhead transmission lines, and similar structures.

**a. Top Mounted Obstruction Light.**

**1. Structures 150 Feet (46m) AGL or Less.** Two or more steady burning (L-810) lights should be installed in a manner to ensure an unobstructed view of one or more lights by a pilot.

**2. Structures Exceeding 150 Feet (46m) AGL.** At least one red flashing (L-864) beacon should be installed in a manner to ensure an unobstructed view of one or more lights by a pilot.

**3. Appurtenances 40 Feet (12m) or Less.** If a rod, antenna, or other appurtenance 40 feet (12m) or less in height is incapable of supporting a red flashing beacon, then it may be placed at the base of the appurtenance. If the mounting location does not allow unobstructed viewing of the beacon by a pilot, then additional beacons should be added.

**4. Appurtenances Exceeding 40 Feet (12m).** If a rod, antenna, or other appurtenance exceeding 40 feet (12m) in height is incapable of supporting a red flashing beacon, a supporting mast with one or more beacons should be installed adjacent to the appurtenance. Adjacent installations should not exceed the height of the appurtenance and be within 40 feet (12m) of the tip to allow the pilot an unobstructed view of at least one beacon.

**b. Mounting Intermediate Levels.** The number of light levels is determined by the height of the structure, including all appurtenances, and is detailed in Appendix 1. The number of lights on each level is

determined by the shape and height of the structure. These lights should be mounted so as to ensure an unobstructed view of at least one light by a pilot.

**1. Steady Burning Lights (L-810).**

**(a) Structures 350 Feet (107m) AGL or Less.**

Two or more steady burning (L-810) lights should be installed on diagonally or diametrically opposite positions.

**(b) Structures Exceeding 350 Feet (107m) AGL.** Install steady burning (L-810) lights on each outside corner of each level.

**2. Flashing Beacons (L-864).**

**(a) Structures 350 Feet (107m) AGL or Less.**

These structures do not require flashing (L-864) beacons at intermediate levels.

**(b) Structure Exceeding 350 Feet (107m) AGL.** At intermediate levels, two beacons (L-864) should be mounted outside at diagonally opposite positions of intermediate levels.

**54. CHIMNEYS, FLARE STACKS, AND SIMILAR SOLID STRUCTURES**

**a. Number of Light Units.**

1. The number of units recommended depends on the diameter of the structure at the top. The number of lights recommended below are the minimum.

2. When the structure diameter is:

**(a) 20 Feet (6m) or Less.** Three light units per level.

**(b) Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).** Four light units per level.

**(c) Exceeding 100 Feet (31m) But Not More Than 200 Feet (61m).** Six light units per level.

**(d) Exceeding 200 Feet (61m).** Eight light units per level.

**b. Top Mounted Obstruction Lights.**

1. **Structures 150 Feet (46m) AGL or Less.** L-810 lights should be installed horizontally at regular intervals at or near the top.

2. **Structures Exceeding 150 Feet (46m) AGL.** At least three L-864 beacons should be installed.

3. **Chimneys, Cooling Towers, and Flare Stacks.** Lights may be displayed as low as 20 feet (6m) below the top to avoid the obscuring effect of deposits and heat generally emitted by this type of structure. It is important that these lights be readily accessible for

cleaning and lamp replacement. It is understood that with flare stacks, as well as any other structures associated with the petrol-chemical industry, normal lighting requirements may not be necessary. This could be due to the location of the flare stack/structure within a large well-lighted petrol-chemical plant or the fact that the flare, or working lights surrounding the flare stack/structure, is as conspicuous as obstruction lights.

**c. Mounting Intermediate Levels.** The number of light levels is determined by the height of the structure including all appurtenances. For cooling towers 600 feet (183m) or less, intermediate light levels are not necessary. Structures exceeding 600 feet (183m) AGL should have a second level of light units installed approximately at the midpoint of the structure and in a vertical line with the top level of lights.

**1. Steady Burning (L-810) Lights.** The recommended number of light levels may be obtained from Appendix 1. At least three lights should be installed on each level.

**2. Flashing (L-864) Beacons.** The recommended number of beacon levels may be obtained from Appendix 1. At least three lights should be installed on each level.

**(a) Structures 350 Feet (107m) AGL or Less.** These structures do not need intermediate levels of flashing beacons.

**(b) Structures Exceeding 350 Feet (107m) AGL.** At least three flashing (L-864) beacons should be installed on each level in a manner to allow an unobstructed view of at least one beacon.

**55. GROUP OF OBSTRUCTIONS**

When individual objects, except wind turbines, within a group of obstructions are not the same height and are spaced a maximum of 150 feet (46m) apart, the prominent objects within the group should be lighted in accordance with the standards for individual obstructions of a corresponding height. If the outer structure is shorter than the prominent, the outer structure should be lighted in accordance with the standards for individual obstructions of a corresponding height. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. In addition, at least one flashing beacon should be installed at the top of a prominent center obstruction or on a special tower located near the center of the group.



**56. ALTERNATE METHOD OF DISPLAYING OBSTRUCTION LIGHTS**

When recommended in an FAA aeronautical study, lights may be placed on poles equal to the height of the obstruction and installed on or adjacent to the structure instead of installing lights on the obstruction.

**57. PROMINENT BUILDINGS, BRIDGES, AND SIMILAR EXTENSIVE OBSTRUCTIONS**

When objects within a group of obstructions are approximately the same overall height above the surface and are located a maximum of 150 feet (46m) apart, the group of obstructions may be considered an extensive obstruction. Install light units on the same horizontal plane at the highest portion or edge of prominent obstructions. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. If the structure is a bridge and is over navigable water, the sponsor must obtain prior approval of the lighting installation from the Commander of the District Office of the United States Coast Guard to avoid interference with marine navigation. Steady burning lights should be displayed to indicate the extent of the obstruction as follows:

**a. Structures 150 Feet (46m) or Less in Any Horizontal Direction.** If the structure/bridge/extensive obstruction is 150 feet (46m) or less horizontally, at least one steady burning light (L-810) should be displayed on the highest point at each end of the major axis of the obstruction. If this is impractical because of the overall shape, display a double obstruction light in the center of the highest point.

**b. Structures Exceeding 150 Feet (46m) in at Least One Horizontal Direction.** If the structure/bridge/extensive obstruction exceeds 150 feet (46m) horizontally, display at least one steady burning light for each 150 feet (46m), or fraction thereof, of the

overall length of the major axis. At least one of these lights should be displayed on the highest point at each end of the obstruction. Additional lights should be displayed at approximately equal intervals not to exceed 150 feet (46m) on the highest points along the edge between the end lights. If an obstruction is located near a landing area and two or more edges are the same height, the edge nearest the landing area should be lighted.

**c. Structures Exceeding 150 Feet (46m) AGL.** Steady burning red obstruction lights should be installed on the highest point at each end. At intermediate levels, steady burning red lights should be displayed for each 150 feet (46m) or fraction thereof. The vertical position of these lights should be equidistant between the top lights and the ground level as the shape and type of obstruction will permit. One such light should be displayed at each outside corner on each level with the remaining lights evenly spaced between the corner lights.

**d. Exceptions.** Flashing red beacons (L-864) may be used instead of steady burning obstruction lights if early or special warning is necessary. These beacons should be displayed on the highest points of an extensive obstruction at intervals not exceeding 3,000 feet (915m). At least three beacons should be displayed on one side of the extensive obstruction to indicate a line of lights.

**e. Ice Shields.** Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units. The light should be mounted in a manner to ensure an unobstructed view of at least one light by a pilot approaching from any direction.

*Final*  
*November 2014*

## CHAPTER 6. MEDIUM INTENSITY FLASHING WHITE OBSTRUCTION LIGHT SYSTEMS

### 60. PURPOSE

Medium intensity flashing white (L-865) obstruction lights may provide conspicuity both day and night. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

### 61. STANDARDS

The medium intensity flashing white light system is normally composed of flashing omnidirectional lights. Medium intensity flashing white obstruction lights may be used during daytime and twilight with automatically selected reduced intensity for nighttime operation. When this system is used on structures 500 feet (153m) AGL or less in height, other methods of marking and lighting the structure may be omitted. Aviation orange and white paint is always required for daytime marking on structures exceeding 500 feet (153m) AGL. This system is not normally recommended on structures 200 feet (61m) AGL or less.

The use of a 24-hour medium intensity flashing white light system in urban/populated areas is not normally recommended due to their tendency to merge with background lighting in these areas at night. This makes it extremely difficult for some types of aviation operations, i.e., med-evac, and police helicopters to see these structures. The use of this type of system in urban and rural areas often results in complaints. In addition, this system is not recommended on structures within 3 nautical miles of an airport.

### 62. RADIO AND TELEVISION TOWERS AND SIMILAR SKELETAL STRUCTURES

**a. Mounting Lights.** The number of levels recommended depends on the height of the structure, including antennas and similar appurtenances.

**1. Top Levels.** One or more lights should be installed at the highest point to provide 360-degree coverage ensuring an unobstructed view.

**2. Appurtenances 40 feet (12m) or less.** If a rod, antenna, or other appurtenance 40 feet (12m) or less in height is incapable of supporting the medium intensity flashing white light, then it may be placed at the base of the appurtenance. If the mounting location does not allow unobstructed viewing of the medium intensity flashing white light by a pilot, then additional lights should be added.

**3. Appurtenances Exceeding 40 feet (12m).** If a rod, antenna, or other appurtenance exceeds 40 feet (12m) above the tip of the main structure, a medium intensity flashing white light should be placed within 40 feet (12m) from the top of the appurtenance. If the appurtenance (such as a whip antenna) is incapable of supporting the light, one or more lights should be mounted on a pole adjacent to the appurtenance. Adjacent installations should not exceed the height of the appurtenance and be within 40 feet (12m) of the tip to allow the pilot an unobstructed view of at least one light.

**b. Intermediate Levels.** At intermediate levels, two beacons (L-865) should be mounted outside at diagonally or diametrically opposite positions of intermediate levels. The lowest light level should not be less than 200 feet (61m) AGL.

**c. Lowest Levels.** The lowest level of light units may be installed at a higher elevation than normal on a structure if the surrounding terrain, trees, or adjacent building(s) would obscure the lights. In certain instances, as determined by an FAA aeronautical study, the lowest level of lights may be eliminated.

**d. Structures 500 Feet (153m) AGL or Less.** When white lights are used during nighttime and twilight only, marking is required for daytime. When operated 24 hours a day, other methods of marking and lighting are not required.

**e. Structures Exceeding 500 Feet (153m) AGL.** The lights should be used during nighttime and twilight and may be used 24 hours a day. Marking is always required for daytime.

**f. Ice Shields.** Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units. The light should be mounted in a manner to ensure an unobstructed view of at least one light by a pilot approaching from any direction.

### 63. CONTROL DEVICE

The light intensity is controlled by a device that changes the intensity when the ambient light changes. The system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

**a. Twilight-to-Night.** This should not occur before the illumination drops below five foot-candles (53.8

lux) but should occur before it drops below two foot-candles (21.5 lux).

**b. *Night-to-Day.*** The intensity changes listed in subparagraph 63a above should be reversed when changing from the night to day mode.

#### **64. CHIMNEYS, FLARE STACKS, AND SIMILAR SOLID STRUCTURES**

**a. *Number of Light Units.*** The number of units recommended depends on the diameter of the structure at the top. Normally, the top level is on the highest point of a structure. However, the top level of chimney lights may be installed as low as 20 feet (6m) below the top to minimize deposit build-up due to emissions. The number of lights recommended are the minimum. When the structure diameter is:

1. *20 Feet (6m) or Less.* Three light units per level.
2. *Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).* Four light units per level.
3. *Exceeding 100 Feet (31m) But Not More Than 200 Feet (61m).* Six light units per level.
4. *Exceeding 200 Feet (61m).* Eight light units per level.

#### **65. GROUP OF OBSTRUCTIONS**

When individual objects within a group of obstructions are not the same height and are spaced a maximum of 150 feet (46m) apart, the prominent objects within the group should be lighted in accordance with the standards for individual obstructions of a corresponding height. If the outer structure is shorter than the prominent, the outer structure should be lighted in accordance with the standards for individual obstructions of a corresponding height. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. In addition, at least one medium intensity flashing white light should be installed at the top of a prominent center obstruction or on a special tower located near the center of the group.

#### **66. SPECIAL CASES**

Where lighting systems are installed on structures located near highways, waterways, airport approach areas, etc., caution should be exercised to ensure that the lights do not distract or otherwise cause a hazard to motorists, vessel operators, or pilots on an approach to an airport. In these cases, shielding may be necessary.

This shielding should not derogate the intended purpose of the lighting system.

#### **67. PROMINENT BUILDINGS AND SIMILAR EXTENSIVE OBSTRUCTIONS**

When objects within a group of obstructions are approximately the same overall height above the surface and are located a maximum of 150 feet (46m) apart, the group of obstructions may be considered an extensive obstruction. Install light units on the same horizontal plane at the highest portion or edge of prominent obstructions. Light units should be placed to ensure that the light is visible to a pilot approaching from **any** direction. Lights should be displayed to indicate the extent of the obstruction as follows:

**a. *Structures 150 Feet (46m) or Less in Any Horizontal Direction.*** If the structure/extensive obstruction is 150 feet (46m) or less horizontally, at least one light should be displayed on the highest point at each end of the major axis of the obstruction. If this is impractical because of the overall shape, display a double obstruction light in the center of the highest point.

**b. *Structures Exceeding 150 Feet (46m) in at Least One Horizontal Direction.*** If the structure/extensive obstruction exceeds 150 feet (46m) horizontally, display at least one light for each 150 feet (46m) or fraction thereof, of the overall length of the major axis. At least one of these lights should be displayed on the highest point at each end of the obstruction. Additional lights should be displayed at approximately equal intervals not to exceed 150 feet (46m) on the highest points along the edge between the end lights. If an obstruction is located near a landing area and two or more edges are the same height, the edge nearest the landing area should be lighted.

**c. *Structures Exceeding 150 Feet (46m) AGL.*** Lights should be installed on the highest point at each end. At intermediate levels, lights should be displayed for each 150 feet (46m), or fraction thereof. The vertical position of these lights should be equidistant between the top lights and the ground level as the shape and type of obstruction will permit. One such light should be displayed at each outside corner on each level with the remaining lights evenly spaced between the corner lights.

**CHAPTER 7. HIGH INTENSITY FLASHING WHITE OBSTRUCTION LIGHT SYSTEMS**

**70. PURPOSE**

Lighting with high intensity (L-856) flashing white obstruction lights provides the highest degree of conspicuity both day and night. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

**71. STANDARDS**

Use high intensity flashing white obstruction lights during daytime with automatically selected reduced intensities for twilight and nighttime operations. When high intensity white lights are operated 24 hours a day, other methods of marking and lighting may be omitted. This system should not be recommended on structures 500 feet (153m) AGL or less unless an FAA aeronautical study shows otherwise.

**72. CONTROL DEVICE**

Light intensity is controlled by a device that changes the intensity when the ambient light changes. The use of a 24-hour high intensity flashing white light system in urban/populated areas is not normally recommended due to their tendency to merge with background lighting in these areas at night. This makes it extremely difficult for some types of aviation operations, i.e., med-evac, and police helicopters to see these structures. The use of this type of system in urban and rural areas often results in complaints.

The system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

- a. *Day-to-Twilight.* This should not occur before the illumination drops to 60 foot-candles (645.8 lux), but should occur before it drops below 35 foot-candles (376.7 lux). The illuminance-sensing device should, if practical, face the northern sky in the Northern Hemisphere.
- b. *Twilight-to-Night.* This should not occur before the illumination drops below five foot-candles (53.8 lux), but should occur before it drops below two foot-candles (21.5 lux).
- c. *Night-to-Day.* The intensity changes listed in subparagraph 72 a and b above should be reversed when changing from the night to day mode.

**73. UNITS PER LEVEL**

One or more light units is needed to obtain the desired horizontal coverage. The number of light units recommended per level (except for the supporting structures of catenary wires and buildings) depends upon the average outside diameter of the specific structure, and the horizontal beam width of the light fixture. The light units should be installed in a manner to ensure an unobstructed view of the system by a pilot approaching from any direction. The number of lights recommended are the minimum. When the structure diameter is:

- a. *20 Feet (6m) or Less.* Three light units per level.
- b. *Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).* Four light units per level.
- c. *Exceeding 100 Feet (31m).* Six light units per level.

**74. INSTALLATION GUIDANCE**

Manufacturing specifications provide for the effective peak intensity of the light beam to be adjustable from zero to 8 degrees above the horizon. Normal installation should place the top light at zero degrees to the horizontal and all other light units installed in accordance with Table 2:

Light Unit Elevation Above the Horizontal	
Height of Light Unit Above Terrain	Degrees of Elevation Above the Horizontal
Exceeding 500 feet AGL	0
401 feet to 500 feet AGL	1
301 feet to 400 feet AGL	2
300 feet AGL or less	3

TBL 2

- a. *Vertical Aiming.* Where terrain, nearby residential areas, or other situations dictate, the light beam may be further elevated above the horizontal. The main beam of light at the lowest level should not strike the ground closer than 3 statute miles (5km) from the structure. If additional adjustments are necessary, the lights may be individually adjusted upward, in 1-degree increments, starting at the bottom. Excessive elevation may reduce its conspicuity by raising the beam above a collision course flight path.
- b. *Special Cases.* Where lighting systems are installed on structures located near highways, waterways, airport approach areas, etc., caution should be exercised to ensure that the lights do not distract or otherwise cause a hazard to motorists, vessel operators, or pilots on an approach to an airport. In these cases,

shielding or an adjustment to the vertical or horizontal light aiming may be necessary. This adjustment should not derogate the intended purpose of the lighting system. Such adjustments may require review action as described in Chapter 1, paragraph 5.

**c. Relocation or Omission of Light Units.** Light units should not be installed in such a manner that the light pattern/output is disrupted by the structure.

**1. Lowest Level.** The lowest level of light units may be installed at a higher elevation than normal on a structure if the surrounding terrain, trees, or adjacent building(s) would obscure the lights. In certain instances, as determined by an FAA aeronautical study, the lowest level of lights may be eliminated.

**2. Two Adjacent Structures.** Where two structures are situated within 500 feet (153m) of each other and the light units are installed at the same levels, the sides of the structures facing each other need not be lighted. However, all lights on both structures must flash simultaneously, except for adjacent catenary support structures. Adjust vertical placement of the lights to either or both structures' intermediate levels to place the lights on the same horizontal plane. Where one structure is higher than the other, complete level(s) of lights should be installed on that part of the higher structure that extends above the top of the lower structure. If the structures are of such heights that the levels of lights cannot be placed in identical horizontal planes, then the light units should be placed such that the center of the horizontal beam patterns do not face toward the adjacent structure. For example, structures situated north and south of each other should have the light units on both structures installed on a northwest/southeast and northeast/southwest orientation.

**3. Three or More Adjacent Structures.** The treatment of a cluster of structures as an individual or a complex of structures will be determined by the FAA as the result of an aeronautical study, taking into consideration the location, heights, and spacing with other structures.

#### **75. ANTENNA OR SIMILAR APPURTENANCE LIGHT**

When a structure lighted by a high intensity flashing light system is topped with an antenna or similar appurtenance exceeding 40 feet (12m) in height, a medium intensity flashing white light (L-865) should be placed within 40 feet (12m) from the tip of the

appurtenance. This light should operate 24 hours a day and flash simultaneously with the rest of the lighting system.

#### **76. CHIMNEYS, FLARE STACKS, AND SIMILAR SOLID STRUCTURES**

The number of light levels depends on the height of the structure excluding appurtenances. Three or more lights should be installed on each level in such a manner to ensure an unobstructed view by the pilot. Normally, the top level is on the highest point of a structure. However, the top level of chimney lights may be installed as low as 20 feet (6m) below the top to minimize deposit build-up due to emissions.

#### **77. RADIO AND TELEVISION TOWERS AND SIMILAR SKELETAL STRUCTURES**

**a. Mounting Lights.** The number of levels recommended depends on the height of the structure, including antennas and similar appurtenances. At least three lights should be installed on each level and mounted to ensure that the effective intensity of the full horizontal beam coverage is not impaired by the structural members.

**b. Top Level.** One level of lights should be installed at the highest point of the structure. If the highest point is a rod or antenna incapable of supporting a lighting system, then the top level of lights should be installed at the highest portion of the main skeletal structure. When guy wires come together at the top, it may be necessary to install this level of lights as low as 10 feet (3m) below the top. If the rod or antenna exceeds 40 feet (12m) above the main structure, a medium intensity flashing white light (L-865) should be mounted on the highest point. If the appurtenance (such as a whip antenna) is incapable of supporting a medium intensity light, one or more lights should be installed on a pole adjacent to the appurtenance. Adjacent installation should not exceed the height of the appurtenance and be within 40 feet (12m) of the top to allow an unobstructed view of at least one light.

**c. Ice Shields.** Where icing is likely to occur, metal grates or similar protective ice shields should be installed directly over each light unit to prevent falling ice or accumulations from damaging the light units.

#### **78. HYPERBOLIC COOLING TOWERS**

Light units should be installed in a manner to ensure an unobstructed view of at least two lights by a pilot approaching from **any** direction.

**a. Number of Light Units.** The number of units recommended depends on the diameter of the structure

at the top. The number of lights recommended in the following table are the minimum. When the structure diameter is:

1. *20 Feet (6m) or Less.* Three light units per level.

2. *Exceeding 20 Feet (6m) But Not More Than 100 Feet (31m).* Four light units per level.

3. *Exceeding 100 Feet (31m) But Not More Than 200 Feet (61m).* Six light units per level.

4. *Exceeding 200 Feet (61m).* Eight light units per level.

**b. Structures Exceeding 600 Feet (183m) AGL.** Structures exceeding 600 feet (183m) AGL should have a second level of light units installed approximately at the midpoint of the structure and in a vertical line with the top level of lights.

#### **79. PROMINENT BUILDINGS AND SIMILAR EXTENSIVE OBSTRUCTIONS**

When objects within a group of obstructions are approximately the same overall height above the surface and are located not more than 150 feet (46m) apart, the group of obstructions may be considered an extensive obstruction. Install light units on the same horizontal plane at the highest portion or edge of prominent obstructions. Light units should be placed

to ensure that the light is visible to a pilot approaching from **any** direction. These lights may require shielding, such as louvers, to ensure minimum adverse impact on local communities. Extreme caution in the use of high intensity flashing white lights should be exercised.

**a. If the Obstruction is 200 feet (61m) or Less in Either Horizontal Dimension,** install three or more light units at the highest portion of the structure in a manner to ensure that at least one light is visible to a pilot approaching from **any** direction. Units may be mounted on a single pedestal at or near the center of the obstruction. If light units are placed more than 10 feet (3m) from the center point of the structure, use a minimum of four units.

**b. If the Obstruction Exceeds 200 Feet (61m) in One Horizontal Dimension,** but is 200 feet (61m) or less in the other, two light units should be placed on each of the shorter sides. These light units may either be installed adjacent to each other at the midpoint of the edge of the obstruction or at (near) each corner with the light unit aimed to provide 180 degrees of coverage at each edge. One or more light units should be installed along the overall length of the major axis. These lights should be installed at approximately equal intervals not to exceed a distance of 100 feet (31m) from the corners or from each other.

**c. If the Obstruction Exceeds 200 Feet (61m) in Both Horizontal Dimensions,** light units should be equally spaced along the overall perimeter of the obstruction at intervals of 100 feet (31m) or fraction thereof.

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**CHAPTER 8. DUAL LIGHTING WITH RED/MEDIUM INTENSITY FLASHING WHITE SYSTEMS**

**80. PURPOSE**

This dual lighting system includes red lights (L-864) for nighttime and medium intensity flashing white lights (L-865) for daytime and twilight use. This lighting system may be used in lieu of operating a medium intensity flashing white lighting system at night. There may be some populated areas where the use of medium intensity at night may cause significant environmental concerns. The use of the dual lighting system should reduce/mitigate those concerns. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

**81. INSTALLATION**

The light units should be installed as specified in the appropriate portions of Chapters 4, 5, and 6. The number of light levels needed may be obtained from Appendix 1.

**82. OPERATION**

Lighting systems should be operated as specified in Chapter 3. Both systems should not be operated at the same time; however, there should be no more than a 2-second delay when changing from one system to the other. Outage of one of two lamps in the uppermost red beacon (L-864 incandescent unit) or outage of any uppermost red light shall cause the white obstruction light system to operate in its specified "night" step intensity.

**83. CONTROL DEVICE**

The light system is controlled by a device that changes the system when the ambient light changes. The system should automatically change steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

**a. *Twilight-to-Night.*** This should not occur before the illumination drops below 5 foot-candles (53.8 lux) but should occur before it drops below 2 foot-candles (21.5 lux).

**b. *Night-to-Day.*** The intensity changes listed in subparagraph 83 a above should be reversed when changing from the night to day mode.

**84. ANTENNA OR SIMILAR APPURTENANCE LIGHT**

When a structure utilizing this dual lighting system is topped with an antenna or similar appurtenance exceeding 40 feet (12m) in height, a medium intensity flashing white (L-865) and a red flashing beacon (L-864) should be placed within 40 feet (12m) from the tip of the appurtenance. The white light should operate during daytime and twilight and the red light during nighttime. These lights should flash simultaneously with the rest of the lighting system.

**85. OMISSION OF MARKING**

When medium intensity white lights are operated on structures 500 feet (153m) AGL or less during daytime and twilight, other methods of marking may be omitted.

*Final*  
*November 2014*

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**CHAPTER 9. DUAL LIGHTING WITH RED/HIGH INTENSITY FLASHING WHITE SYSTEMS**

**90. PURPOSE**

This dual lighting system includes red lights (L-864) for nighttime and high intensity flashing white lights (L-856) for daytime and twilight use. This lighting system may be used in lieu of operating a flashing white lighting system at night. There may be some populated areas where the use of high intensity lights at night may cause significant environmental concerns and complaints. The use of the dual lighting system should reduce/mitigate those concerns. Recommendations on lighting structures can vary depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, number of structures and overall layout of design.

**91. INSTALLATION**

The light units should be installed as specified in the appropriate portions of Chapters 4, 5, and 7. The number of light levels needed may be obtained from Appendix 1.

**92. OPERATION**

Lighting systems should be operated as specified in Chapters 4, 5, and 7. Both systems should not be operated at the same time; however, there should be no more than a 2-second delay when changing from one system to the other. Outage of one of two lamps in the uppermost red beacon (L-864 incandescent unit) or outage of any uppermost red light shall cause the white obstruction light system to operate in its specified "night" step intensity.

**93. CONTROL DEVICE**

The light intensity is controlled by a device that changes the intensity when the ambient light changes.

The system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

**a. Day-to-Twilight.** This should not occur before the illumination drops to 60 foot-candles (645.8 lux) but should occur before it drops below 35 foot-candles (376.7 lux). The illuminance-sensing device should, if practical, face the northern sky in the Northern Hemisphere.

**b. Twilight-to-Night.** This should not occur before the illumination drops below 5 foot-candles (53.8 lux) but should occur before it drops below 2 foot-candles (21.5 lux).

**c. Night-to-Day.** The intensity changes listed in subparagraph 93 a and b above should be reversed when changing from the night to day mode.

**94. ANTENNA OR SIMILAR APPURTENANCE LIGHT**

When a structure utilizing this dual lighting system is topped with an antenna or similar appurtenance exceeding 40 feet (12m) in height, a medium intensity flashing white light (L-865) and a red flashing beacon (L-864) should be placed within 40 feet (12m) from the tip of the appurtenance. The white light should operate during daytime and twilight and the red light during nighttime.

**95. OMISSION OF MARKING**

When high intensity white lights are operated during daytime and twilight, other methods of marking may be omitted.

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## CHAPTER 10. MARKING AND LIGHTING OF CATENARY AND CATENARY SUPPORT STRUCTURES

### 100. PURPOSE

This chapter provides guidelines for marking and lighting catenary and catenary support structures. The recommended marking and lighting of these structures is intended to provide day and night conspicuity and to assist pilots in identifying and avoiding catenary wires and associated support structures.

### 101. CATENARY MARKING STANDARDS

Lighted markers are available for increased night conspicuity of high-voltage (69KV or greater) transmission line catenary wires. These markers should be used on transmission line catenary wires near airports, heliports, across rivers, canyons, lakes, etc. The lighted markers should be manufacturer certified as recognizable from a minimum distance of 4,000 feet (1219m) under nighttime conditions, minimum VFR conditions or having a minimum intensity of at least 32.5 candela. The lighting unit should emit a steady burning red light. They should be used on the highest energized line. If the lighted markers are installed on a line other than the highest catenary, then markers specified in paragraph 34 should be used in addition to the lighted markers. (The maximum distance between the line energizing the lighted markers and the highest catenary above the lighted marker should be no more than 20 feet (6m).) Markers should be distinctively shaped, i.e., spherical, cylindrical, so they are not mistaken for items that are used to convey other information. They should be visible in all directions from which aircraft are likely to approach. The area in the immediate vicinity of the supporting structure's base should be clear of all items and/or objects of natural growth that could interfere with the line-of-sight between a pilot and the structure's lights. Where a catenary wire crossing requires three or more supporting structures, the inner structures should be equipped with enough light units per level to provide a full coverage.

**a. Size and Color.** The diameter of the markers used on extensive catenary wires across canyons, lakes, rivers, etc., should be not less than 36 inches (91cm). Smaller 20-inch (51cm) markers are permitted on less extensive power lines or on power lines below 50 feet (15m) above the ground and within 1,500 feet (458m) of an airport runway end. Each marker should be a solid color such as aviation orange, white, or yellow.

#### **b. Installation.**

**1. Spacing.** Lighted markers should be spaced equally along the wire at intervals of approximately 200 feet (61m) or a fraction thereof. Intervals between

markers should be less in critical areas near runway ends, i.e., 30 to 50 feet (10m to 15m). If the markers are installed on a line other than the highest catenary, then markers specified in paragraph 34 should be used in addition to the lighted markers. The maximum distance between the line energizing the lighted markers and the highest catenary above the markers can be no more than 20 feet (6m). The lighted markers may be installed alternately along each wire if the distance between adjacent markers meets the spacing standard. This method allows the weight and wind loading factors to be distributed.

**2. Pattern.** An alternating color scheme provides the most conspicuity against all backgrounds. Mark overhead wires by alternating solid colored markers of aviation orange, white, and yellow. Normally, an orange marker is placed at each end of a line and the spacing is adjusted (not to exceed 200 feet (61m)) to accommodate the rest of the markers. When less than four markers are used, they should all be aviation orange.

### 102. CATENARY LIGHTING STANDARDS

When using medium intensity flashing white (L-866), high intensity flashing white (L-857), dual medium intensity (L-866/L-885) or dual high intensity (L-857/885) lighting systems, operated 24 hours a day, other marking of the support structure is not necessary.

**a. Levels.** A system of three levels of sequentially flashing light units should be installed on each supporting structure or adjacent terrain. Install one level at the top of the structure, one at the height of the lowest point in the catenary and one level approximately midway between the other two light levels. The middle level should normally be at least 50 feet (15m) from the other two levels. The middle light unit may be deleted when the distance between the top and the bottom light levels is less than 100 feet (30m).

**1. Top Levels.** One or more lights should be installed at the top of the structure to provide 360-degree coverage ensuring an unobstructed view. If the installation presents a potential danger to maintenance personnel, or when necessary for lightning protection, the top level of lights may be mounted as low as 20 feet (6m) below the highest point of the structure.

**2. Horizontal Coverage.** The light units at the middle level and bottom level should be installed so as to provide a minimum of 180-degree coverage centered perpendicular to the flyway. Where a catenary crossing is situated near a bend in a river, canyon, etc., or is not perpendicular to the flyway, the

horizontal beam should be directed to provide the most effective light coverage to warn pilots approaching from either direction of the catenary wires.

**3. Variation.** The vertical and horizontal arrangements of the lights may be subject to the structural limits of the towers and/or adjacent terrain. A tolerance of 20 percent from uniform spacing of the bottom and middle light is allowed. If the base of the supporting structure(s) is higher than the lowest point in the catenary, such as a canyon crossing, one or more lights should be installed on the adjacent terrain at the level of the lowest point in the span. These lights should be installed on the structure or terrain at the height of the lowest point in the catenary.

**b. Flash Sequence.** The flash sequence should be middle, top, and bottom with all lights on the same level flashing simultaneously. The time delay between flashes of levels is designed to present a unique system display. The time delay between the start of each level of flash duration is outlined in FAA AC 150/5345-43, Specification for Obstruction Lighting Equipment.

**c. Synchronization.** Although desirable, the corresponding light levels on associated supporting towers of a catenary crossing need not flash simultaneously.

**d. Structures 500 feet (153m) AGL or Less.** When medium intensity white lights (L-866) are operated 24 hours a day, or when a dual red/medium intensity system (L-866 daytime & twilight/L-885 nighttime) is used, marking can be omitted. When using a medium intensity white light (L-866) or a flashing red light (L-885) during twilight or nighttime only, painting should be used for daytime marking.

**e. Structures Exceeding 500 Feet (153m) AGL.** When high intensity white lights (L-857) are operated 24 hours a day, or when a dual red/high intensity system (L-857 daytime and twilight/L-885 nighttime) is used, marking can be omitted. This system should not be recommended on structures 500 feet (153m) or less unless an FAA aeronautical study shows otherwise. When a flashing red obstruction light (L-885), a medium intensity (L-866) flashing white lighting system or a high intensity white lighting system (L-857) is used for nighttime and twilight only, painting should be used for daytime marking.

### **103. CONTROL DEVICE**

The light intensity is controlled by a device (photo cell) that changes the intensity when the ambient light changes. The lighting system should automatically change intensity steps when the northern sky illumination in the Northern Hemisphere on a vertical surface is as follows:

**a. Day-to-Twilight (L-857 System).** This should not occur before the illumination drops to 60 foot-candles (645.8 lux), but should occur before it drops below 35 foot-candles (376.7 lux). The illuminant-sensing device should, if practical, face the northern sky in the Northern Hemisphere.

**b. Twilight-to-Night (L-857 System).** This should not occur before the illumination drops below 5 foot-candles (53.8 lux), but should occur before it drops below 2 foot-candles (21.5 lux).

**c. Night-to-Day.** The intensity changes listed in subparagraph 103 a. and b. above should be reversed when changing from the night to day mode.

**d. Day-to-Night (L-866 or L-885/L-866).** This should not occur before the illumination drops below 5 foot-candles (563.8 lux) but should occur before it drops below 2 foot-candles (21.5 lux).

**e. Night-to-Day.** The intensity changes listed in subparagraph d. above should be reversed when changing from the night to day mode.

**f. Red Obstruction (L-885).** The red lights should not turn on until the illumination drops below 60 foot-candles (645.8 lux) but should occur before reaching a level of 35 foot-candles (367.7 lux). Lights should not turn off before the illuminance rises above 35 foot-candles (367.7 lux), but should occur before reaching 60 foot-candles (645.8 lux).

### **104. AREA SURROUNDING CATENARY SUPPORT STRUCTURES**

The area in the immediate vicinity of the supporting structure's base should be clear of all items and/or objects of natural growth that could interfere with the line-of-sight between a pilot and the structure's lights.

### **105. THREE OR MORE CATENARY SUPPORT STRUCTURES**

Where a catenary wire crossing requires three or more supporting structures, the inner structures should be equipped with enough light units per level to provide a full 360-degree coverage.

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**CHAPTER 11. MARKING AND LIGHTING MOORED BALLOONS AND KITES**

**110. PURPOSE**

The purpose of marking and lighting moored balloons, kites, and their cables or mooring lines is to indicate the presence and general definition of these objects to pilots when converging from any normal angle of approach.

**111. STANDARDS**

These marking and lighting standards pertain to all moored balloons and kites that require marking and lighting under 14 CFR, part 101.

**112. MARKING**

Flag markers should be used on mooring lines to warn pilots of their presence during daylight hours.

**a. Display.** Markers should be displayed at no more than 50-foot (15m) intervals and should be visible for at least 1 statute mile.

**b. Shape.** Markers should be rectangular in shape and not less than 2 feet (0.6m) on a side. Stiffeners should be used in the borders so as to expose a large area, prevent drooping in calm wind, or wrapping around the cable.

**c. Color Patterns.** One of the following color patterns should be used:

**1. Solid Color.** Aviation orange.

**2. Orange and White.** Two triangular sections, one of aviation orange and the other white, combined to form a rectangle.

**113. PURPOSE**

Flashing obstruction lights should be used on moored balloons or kites and their mooring lines to warn pilots of their presence during the hours between sunset and sunrise and during periods of reduced visibility. These lights may be operated 24 hours a day.

**a. Systems.** Flashing red (L-864) or white beacons (L-865) may be used to light moored balloons or kites. High intensity lights (L-856) are not recommended.

**b. Display.** Flashing lights should be displayed on the top, nose section, tail section, and on the tether cable approximately 15 feet (4.6m) below the craft so as to define the extremes of size and shape. Additional lights should be equally spaced along the cable's overall length for each 350 feet (107m) or fraction thereof.

**c. Exceptions.** When the requirements of this paragraph cannot be met, floodlighting may be used.

**114. OPERATIONAL CHARACTERISTICS**

The light intensity is controlled by a device that changes the intensity when the ambient light changes. The system should automatically turn the lights on and change intensities as ambient light condition change. The reverse order should apply in changing from nighttime to daytime operation. The lights should flash simultaneously.

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**CHAPTER 12. MARKING AND LIGHTING EQUIPMENT AND INFORMATION**

**120. PURPOSE**

This chapter lists documents relating to obstruction marking and lighting systems and where they may be obtained.

**121. PAINT STANDARD**

Paint and aviation colors/gloss, referred to in this publication should conform to Federal Standard FED-STD-595. Approved colors shall be formulated without the use of Lead, Zinc Chromate or other heavy metals to match International Orange, White and Yellow. All coatings shall be manufactured and labeled to meet Federal Environmental Protection Act Volatile Organic Compound(s) guidelines, including the National Volatile Organic Compound Emission Standards for architectural coatings.

**a. Exterior Acrylic Waterborne Paint.** Coating should be a ready mixed, 100% acrylic, exterior latex formulated for application directly to galvanized surfaces. Ferrous iron and steel or non-galvanized surfaces shall be primed with a manufacturer recommended primer compatible with the finish coat.

**b. Exterior Solventborne Alkyd Based Paint.** Coating should be ready mixed, alkyd-based, exterior enamel for application directly to non-galvanized surfaces such as ferrous iron and steel. Galvanized surfaces shall be primed with a manufacturer primer compatible with the finish coat.

**Paint Standards Color Table**

COLOR	NUMBER
Orange	12197
White	17875
Yellow	13538

*TBL 3*

*Note-*

1. Federal specification T1-P-59, aviation surface paint, ready mixed international orange.
2. Federal specification T1-102, aviation surface paint, oil titanium zinc.
3. Federal specification T1-102, aviation surface paint, oil, exterior, ready mixed, white and light tints.

**122. AVAILABILITY OF SPECIFICATIONS**

Federal specifications describing the technical characteristics of various paints and their application techniques may be obtained from:

GSA- Specification Branch 470 L'Enfant Plaza Suite 8214 Washington, DC 20407 Telephone: (202) 619-8925
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**123. LIGHTS AND ASSOCIATED EQUIPMENT**

The lighting equipment referred to in this publication should conform to the latest edition of one of the following specifications, as applicable:

**a. Obstruction Lighting Equipment.**

1. AC 150/5345-43, FAA Specification for Obstruction Lighting Equipment.
2. Military Specifications MIL-L-6273, Light, Navigational, Beacon, Obstacle or Code, Type G-1.
3. Military Specifications MIL-L-7830, Light Assembly, Markers, Aircraft Obstruction.

**b. Certified Equipment.**

1. AC 150/5345-53, Airport Lighting Certification Program, lists the manufacturers that have demonstrated compliance with the specification requirements of AC 150/5345-43.
2. Other manufacturers' equipment may be used provided that equipment meets the specification requirements of AC 150/5345-43.

**c. Airport Lighting Installation and Maintenance.**

1. AC 150/5340-21, Airport Miscellaneous Lighting Visual Aids, provides guidance for the installation, maintenance, testing, and inspection of obstruction lighting for airport visual aids such as airport beacons, wind cones, etc.
2. AC 150/5340-26, Maintenance of Airport Visual Aid Facilities, provides guidance on the maintenance of airport visual aid facilities.

**d. Vehicles.**

1. AC 150/5210-5, Painting, Marking, and Lighting of Vehicles Used on an Airport, contains provisions for marking vehicles principally used on airports.
2. FAA Facilities. Obstruction marking for FAA facilities shall conform to FAA Drawing Number D-5480, referenced in FAA Standard FAA-STD-003, Paint Systems for Structures.

**124. AVAILABILITY**

The standards and specifications listed above may be obtained free of charge from the below-indicated office:

**a. Military Specifications:**

Standardization Document Order Desk 700 Robbins Avenue Building #4, Section D Philadelphia, PA 19111-5094
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**b. FAA Specifications:**

Manager, ASD-110 Department of Transportation Document Control Center Martin Marietta/Air Traffic Systems 475 School St., SW. Washington, DC 20024 Telephone: (202) 646-2047 FAA Contractors Only
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**c. FAA Advisory Circulars:**

Department of Transportation TASC Subsequent Distribution Office, SVC-121.23 Ardmore East Business Center 3341 Q 75th Avenue Landover, MD 20785 Telephone: (301) 322-4961
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**CHAPTER 13. MARKING AND LIGHTING WIND TURBINE FARMS**

**130. PURPOSE**

This chapter provides guidelines for the marking and lighting of wind turbine farms. For the purposes of this advisory circular, wind turbine farms are defined as a wind turbine development that contains more than three (3) turbines of heights over 200 feet above ground level. The recommended marking and lighting of these structures is intended to provide day and night conspicuity and to assist pilots in identifying and avoiding these obstacles.

**131. GENERAL STANDARDS**

The development of wind turbine farms is a very dynamic process, which constantly changes based on the differing terrain they are built on. Each wind turbine farm is unique; therefore it is important to work closely with the sponsor to determine a lighting scheme that provides for the safety of air traffic. The following are guidelines that are recommended for wind turbine farms. Consider the proximity to airports and VFR routes, extreme terrain where heights may widely vary, and local flight activity when making the recommendation.

a. Not all wind turbine units within an installation or farm need to be lighted. Definition of the periphery of the installation is essential; however, lighting of interior wind turbines is of lesser importance unless they are taller than the peripheral units.

b. Obstruction lights within a group of wind turbines should have unlighted separations or gaps of no more than ½ statute mile if the integrity of the group appearance is to be maintained. This is especially critical if the arrangement of objects is essentially linear.

c. Any array of flashing or pulsed obstruction lighting should be synchronized or flash simultaneously.

d. Nighttime wind turbine obstruction lighting should consist of the preferred FAA L-864 aviation red-colored flashing lights.

e. White strobe fixtures (FAA L-865) may be used in lieu of the preferred L-864 red flashing lights, but must be used alone without any red lights, and must be positioned in the same manner as the red flashing lights.

f. The white paint most often found on wind turbine units is the most effective daytime early warning device. Other colors, such as light gray or blue, appear to be significantly less effective in

providing daytime warning. Daytime lighting of wind turbine farms is not required, as long as the turbine structures are painted in a bright white color or light off-white color most often found on wind turbines.

**132. WIND TURBINE CONFIGURATIONS** – Prior to recommending marking and lighting, determine the configuration and the terrain of the wind turbine farm. The following is a description of the most common configurations.

a. Linear – wind turbine farms in a line-like arrangement, often located along a ridge line, the face of a mountain or along borders of a mesa or field. The line may be ragged in shape or be periodically broke, and may vary in size from just a few turbines up to 20 miles long.

b. Cluster – turbine farms where the turbines are placed in circles like groups on top of a mesa, or within a large field. A cluster is typically characterized by having a pronounced perimeter, with various turbines placed inside the circle at various, erratic distances throughout the center of the circle.

c. Grid – turbine farms arranged in a geographical shape such as a square or a rectangle, where each turbine is set a consistent distance from each other in rows, giving the appearance that they are part of a square like pattern.

**133. MARKING STANDARDS**

The bright white or light off-white paint most often found on wind turbines has been shown to be most effective, and if used, no lights are required during the daytime. However, if darker paint is used, wind turbine marking should be supplemented with daytime lighting, as required.

**134. LIGHTING STANDARDS**

a. Flashing red (L864), or white (L-865) lights may be used to light wind turbines. Studies have shown that red lights are most effective, and should be the first consideration for lighting recommendations of wind turbines.

b. Obstruction lights should have unlighted separations or gaps of no more than ½ mile. Lights should flash simultaneously. Should the synchronization of the lighting system fail, a lighting outage report should be made in accordance with paragraph 23 of this advisory circular. Light fixtures should be placed as high as possible on the turbine nacelle, so as to be visible from 360 degrees.

c. Linear Turbine Configuration. Place a light on each turbine positioned at each end of the line or string of turbines. Lights should be no more than ½ statute mile, or 2640 feet from the last lit turbine. In the event the last segment is significantly short, push the lit turbines back towards the starting point to present a well balanced string of lights. High concentrations of lights should be avoided.

d. Cluster Turbine Configuration. Select a starting point among the outer perimeter of the cluster. This turbine should be lit, and a light should be placed on the next turbine so that no more than a ½ statute mile gap exists. Continue this pattern around the perimeter. If the distance across the cluster is greater than 1 mile, and/or the terrain varies by more than 100 feet, place one or more lit turbines at locations throughout the center of the cluster.

e. Grid Turbine Configuration. Select each of the defined corners of the layout to be lit, and then utilize the same concept of the cluster configuration as outlined in paragraph d.

f. Special Considerations. On occasion, one or two turbines may be located apart from the main grouping of turbines. If one or two turbines protrude from the general limits of the turbine farm, these turbines should be lit.

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**APPENDIX 1: Specifications for Obstruction Lighting Equipment Classification**

**APPENDIX**

Type	Description
L-810	Steady-burning Red Obstruction Light
L-856	High Intensity Flashing White Obstruction Light (40 FPM)
L-857	High Intensity Flashing White Obstruction Light (60 FPM)
L-864	Flashing Red Obstruction Light (20-40 FPM)
L-865	Medium Intensity Flashing White Obstruction Light (40-FPM)
L-866	Medium Intensity Flashing White Obstruction Light (60-FPM)
L-864/L-865	Dual: Flashing Red Obstruction Light (20-40 FPM) and Medium Intensity Flashing White Obstruction Light (40 FPM)
L-885	Red Catenary 60 FPM
FPM = Flashes Per Minute	

*TBL 4*

PAINTING AND/OR DUAL LIGHTING OF CHIMNEYS, POLES, TOWERS, AND SIMILAR STRUCTURES

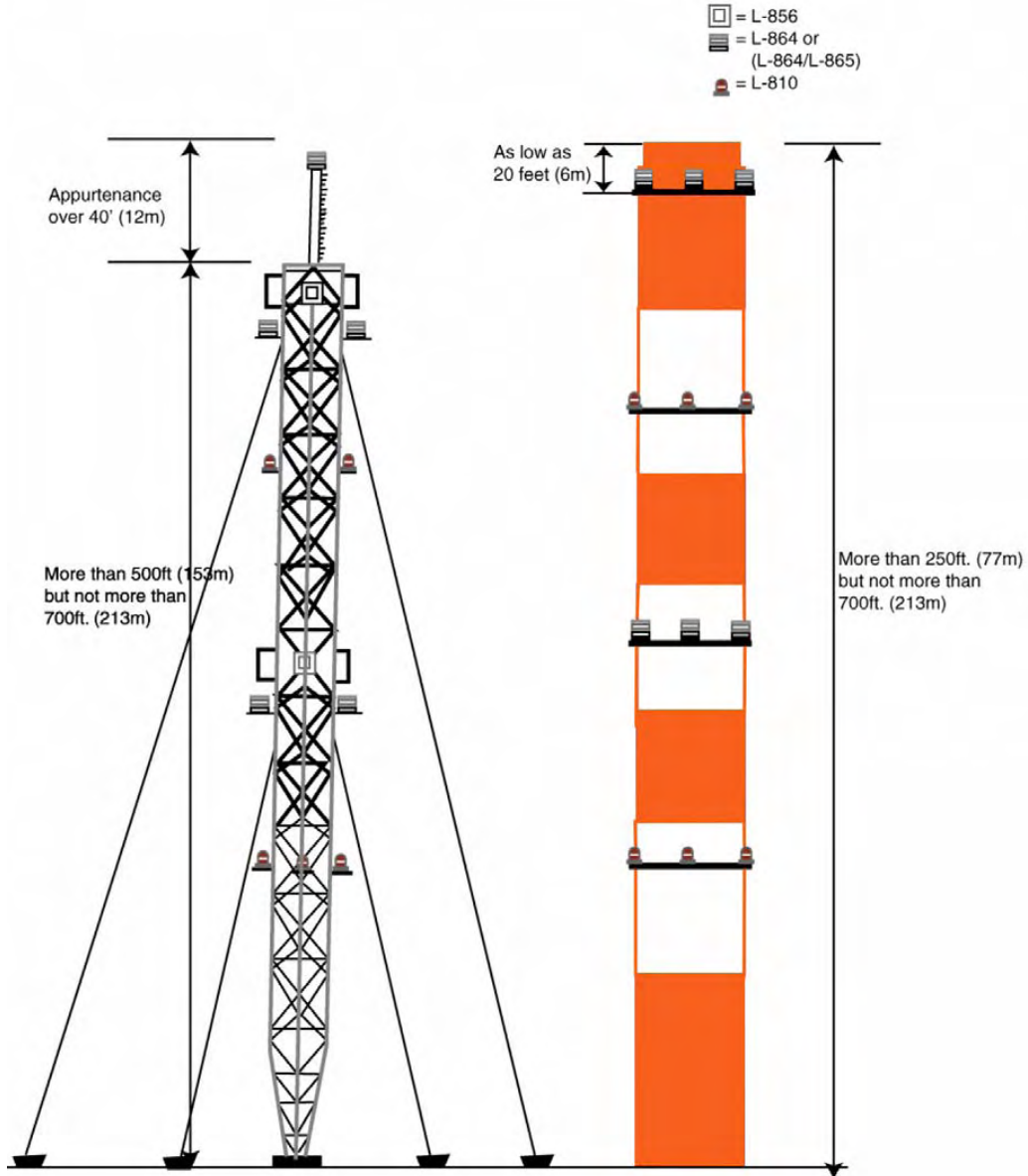
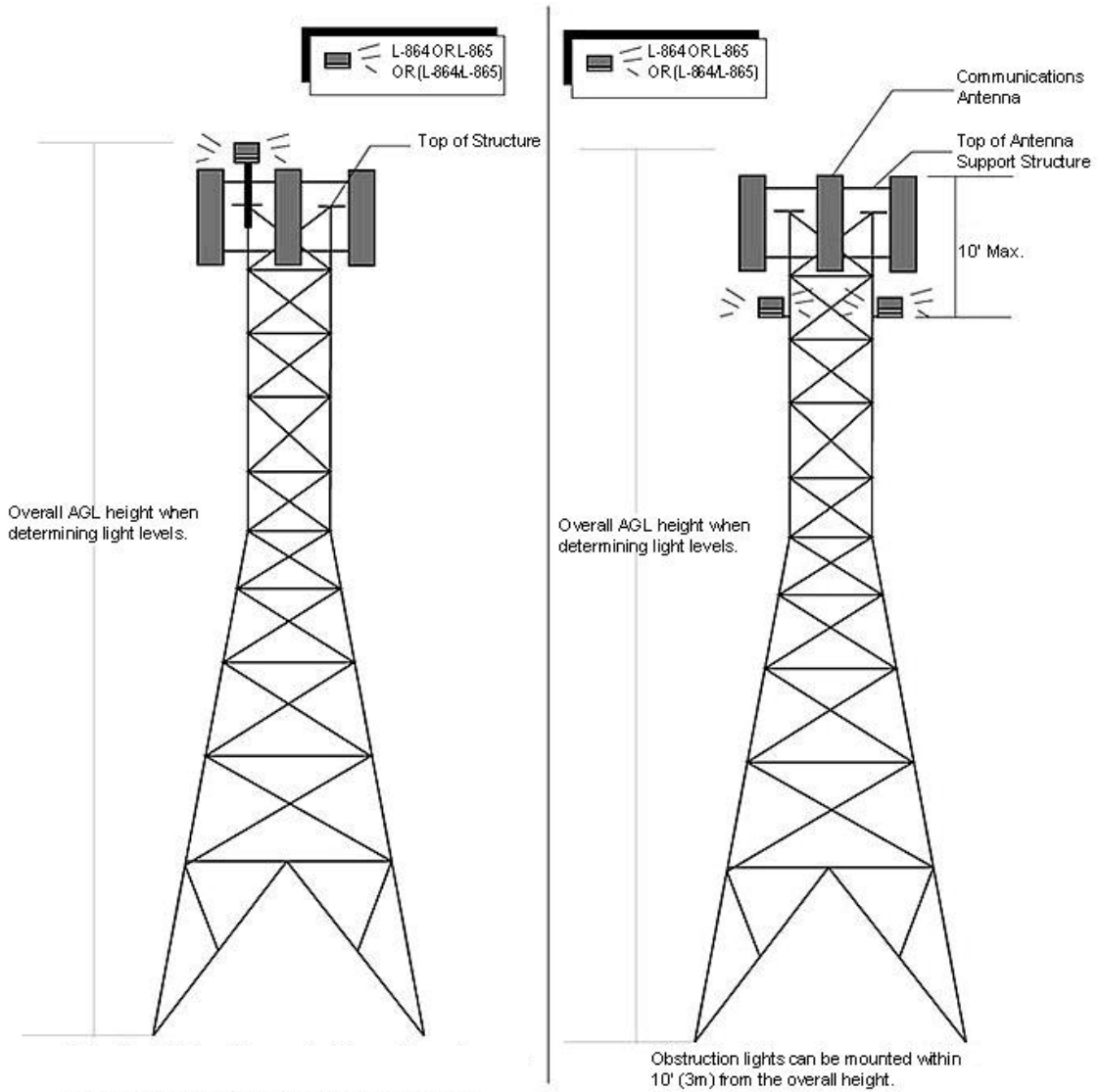


FIG 1



Intermediate lighting not shown. Overall AGL height if more than 200' (61m), but not more than 500' (153m).

FIG 2

PAINTING AND LIGHTING OF WATER TOWERS, STORAGE TANKS, AND SIMILAR STRUCTURES

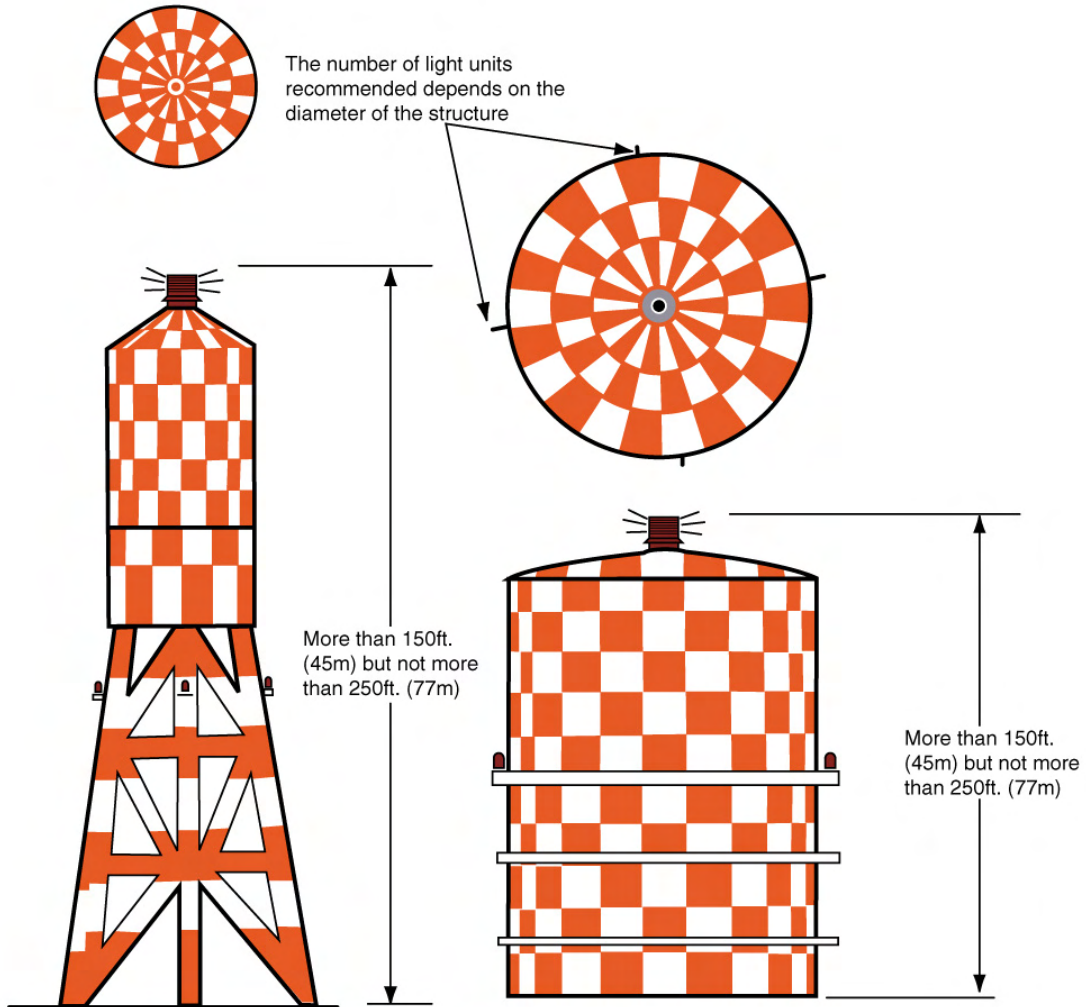


FIG 3



PAINTING AND LIGHTING OF WATER TOWERS ANDE SIMILAR STRUCTURES

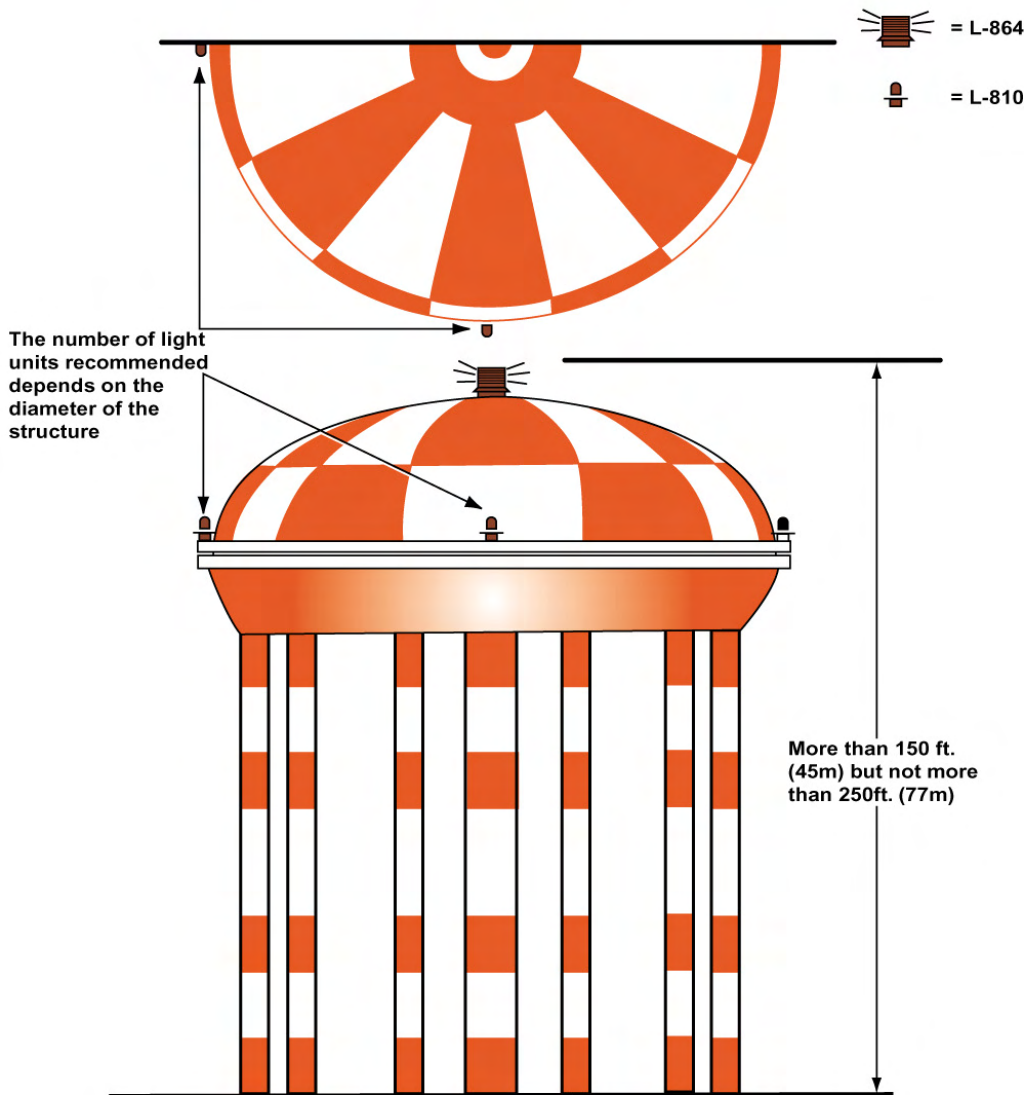


FIG 4

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PAINTING OF SINGLE PEDESTAL WATER TOWER BY TEARDROP PATTERN

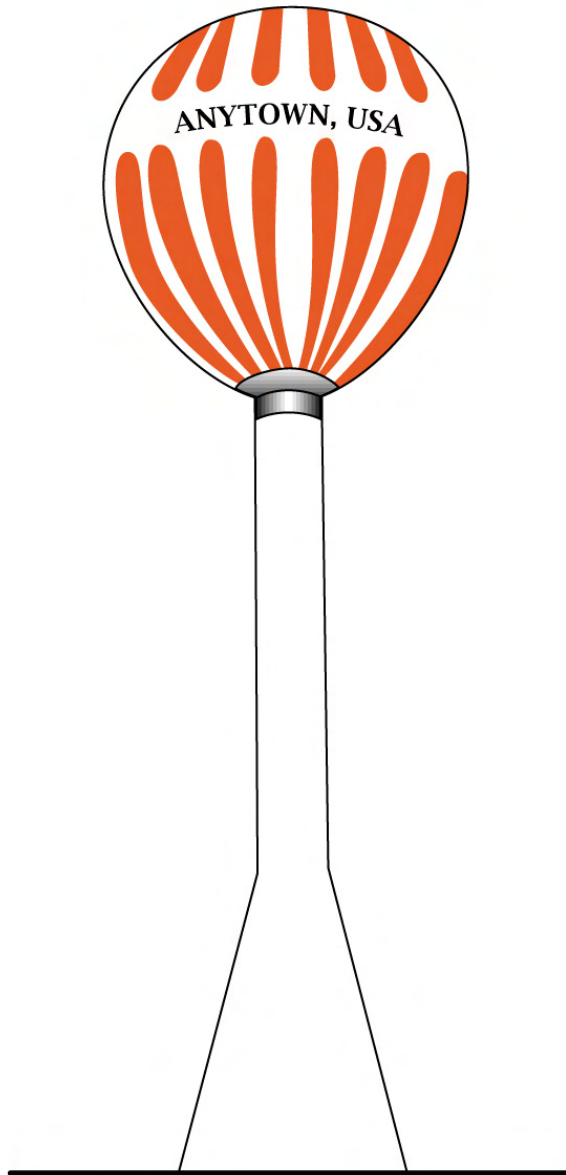
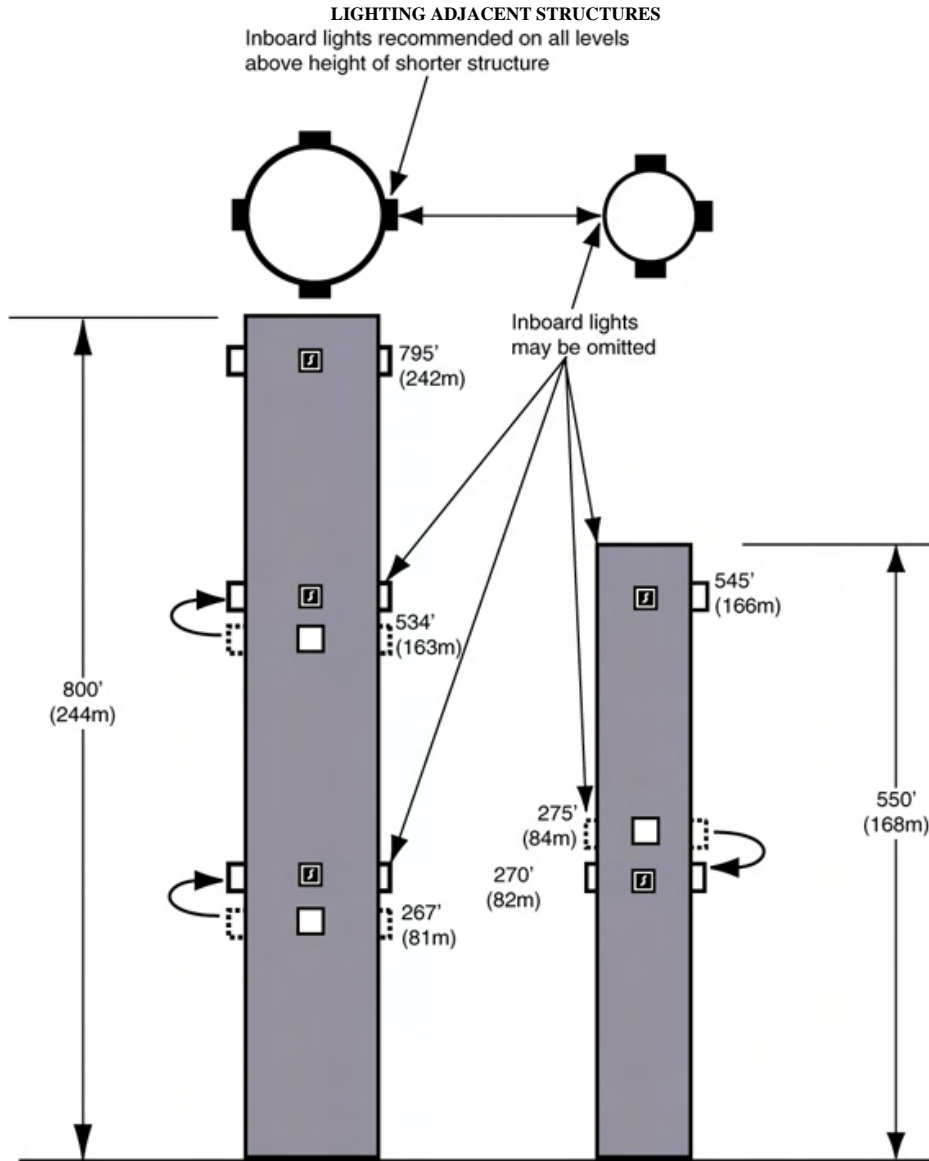


FIG 5



Minor adjustments in vertical placement may be made to place lights on same horizontal plane. Lights on both structures be synchronized

FIG 6

Lighting Adjacent Structure

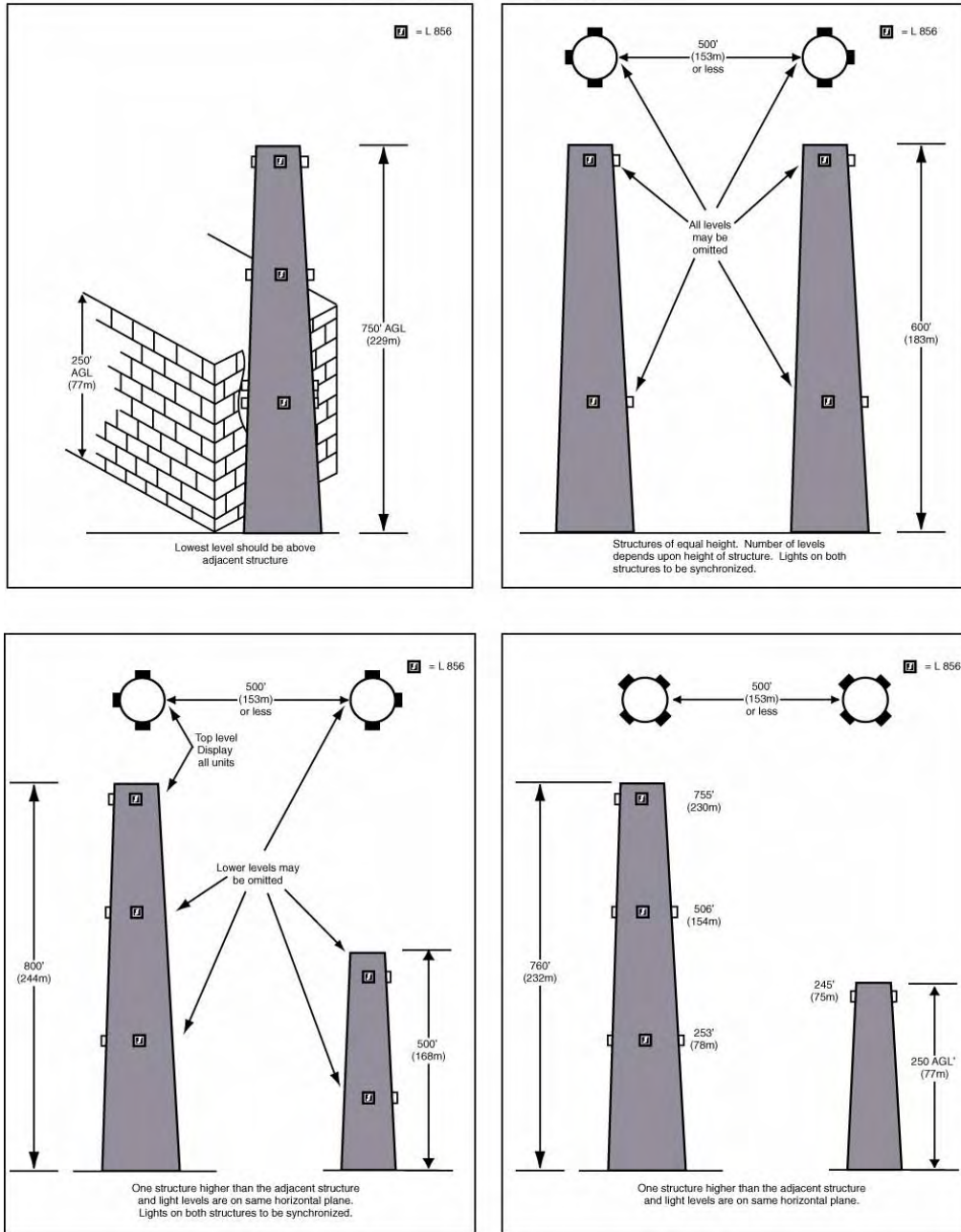


FIG 7

Lighting Adjacent Structure

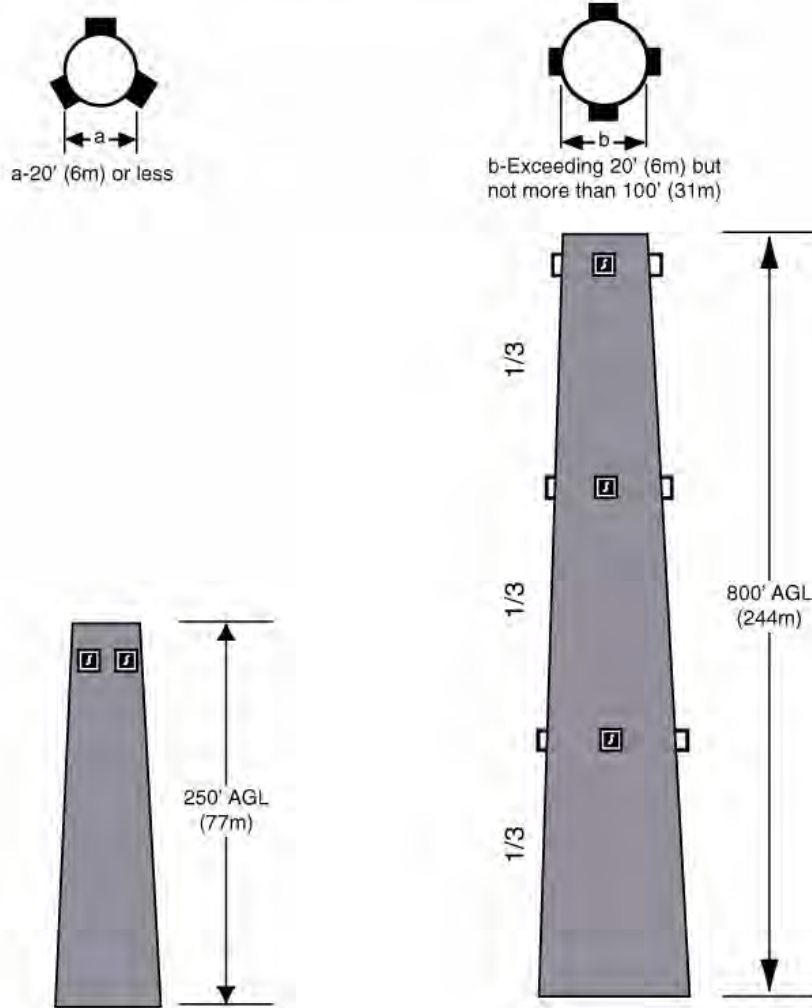


FIG 8

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HYPERBOLIC COOLING TOWER

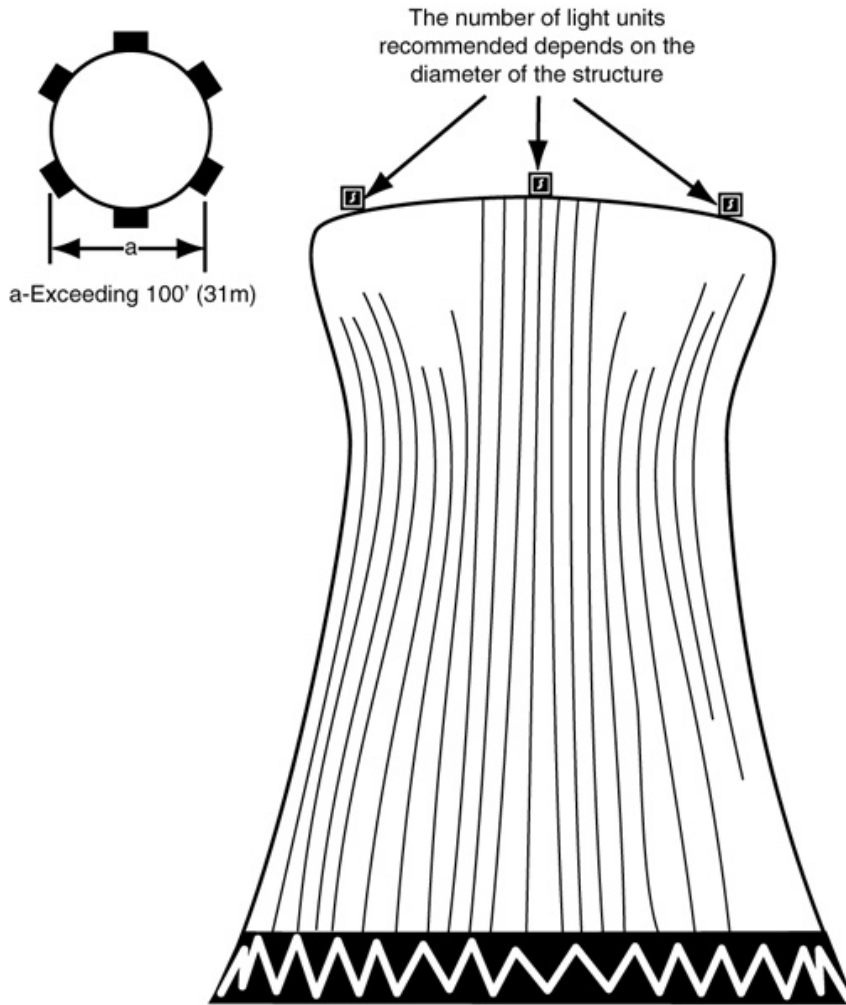


FIG 9

BRIDGE LIGHTING

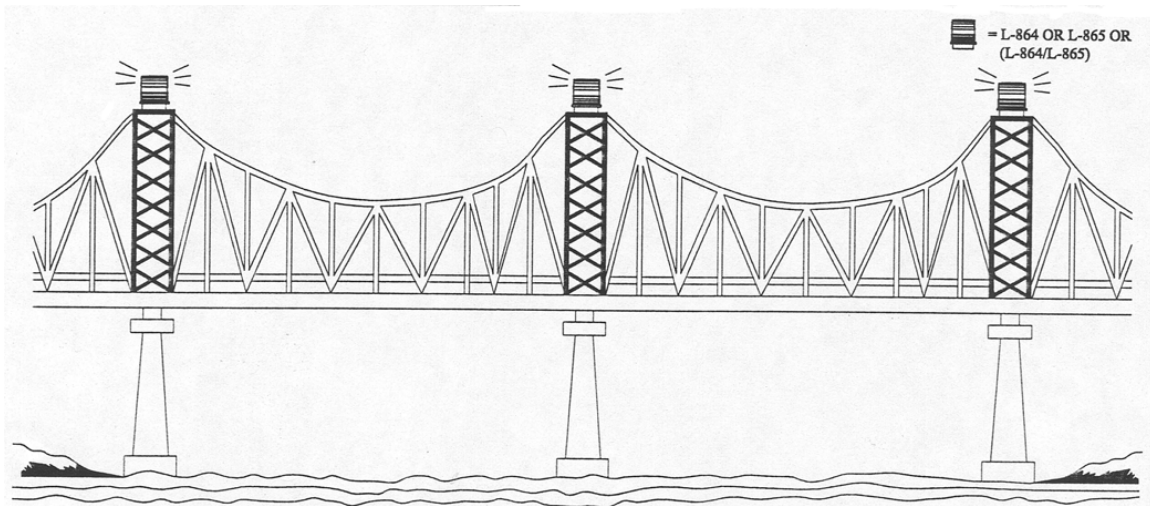
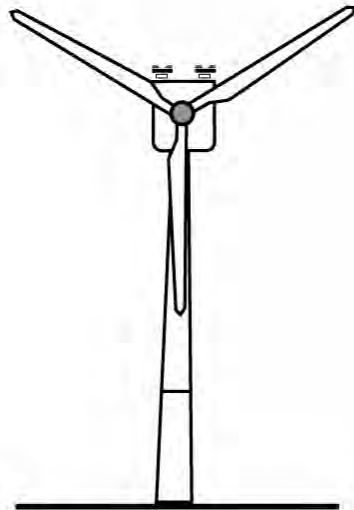


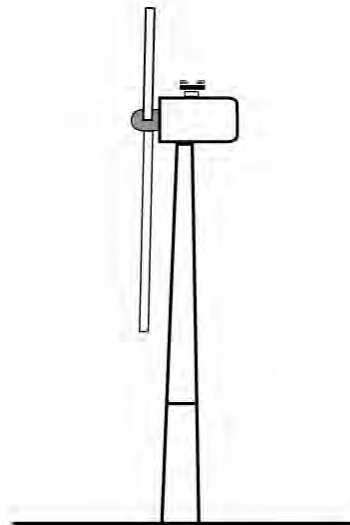
FIG 10

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TYPICAL LIGHTING OF A STAND ALONE WIND TURBINE



Front View



Side View

FIG 11



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WIND TURBINE GENERATOR

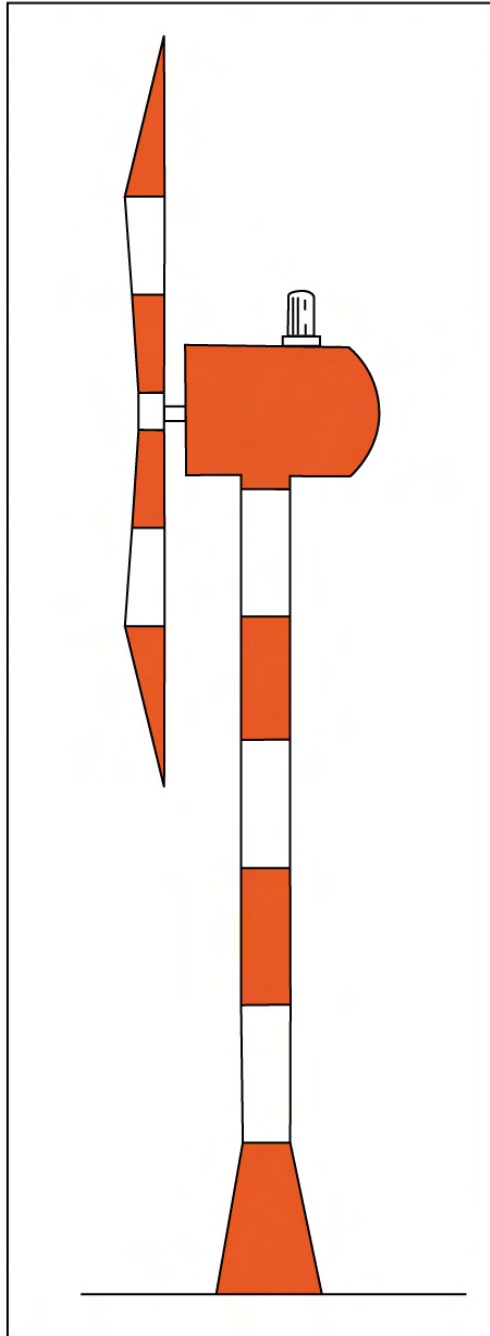


FIG 12

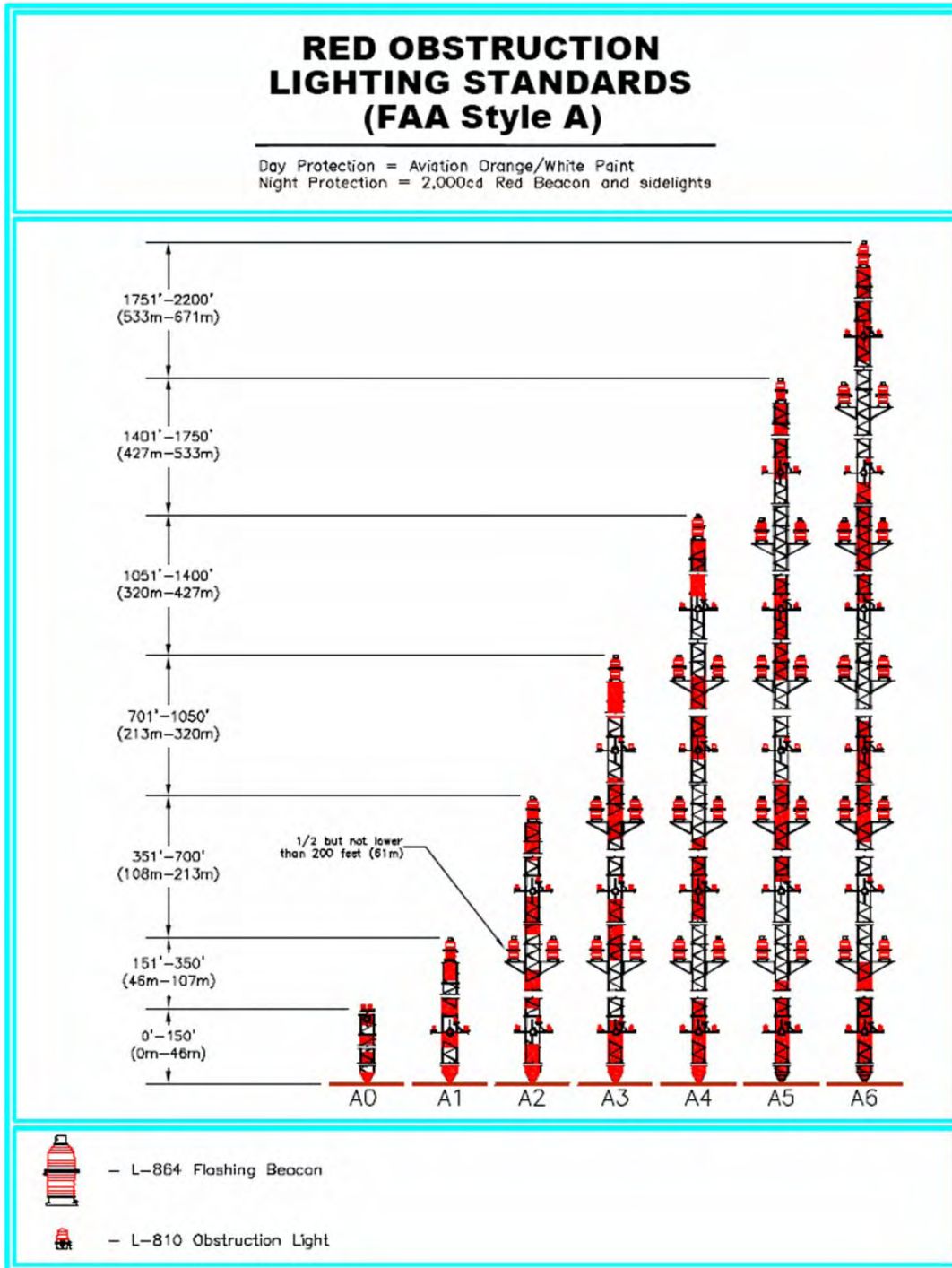


FIG 13

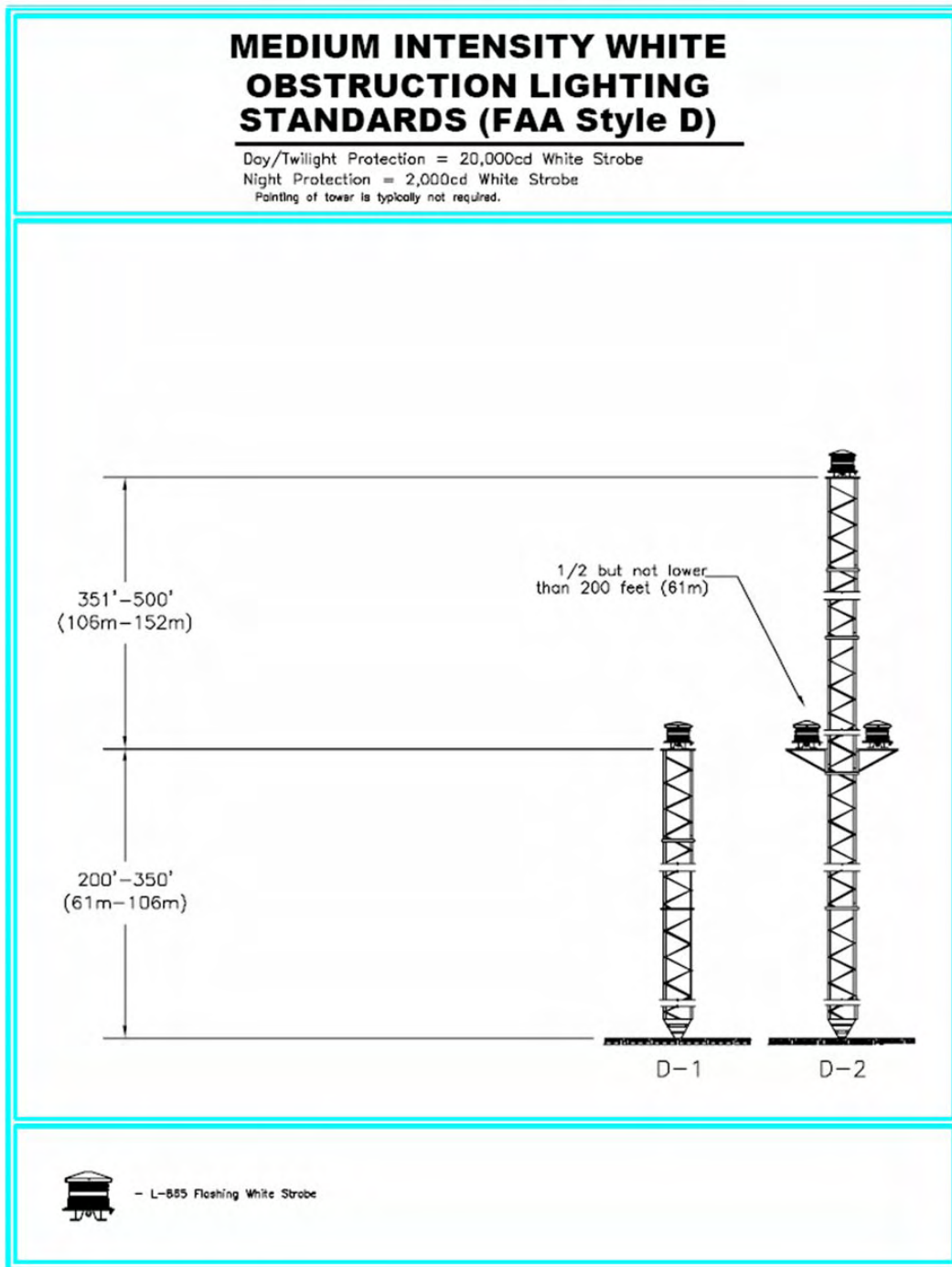


FIG 14

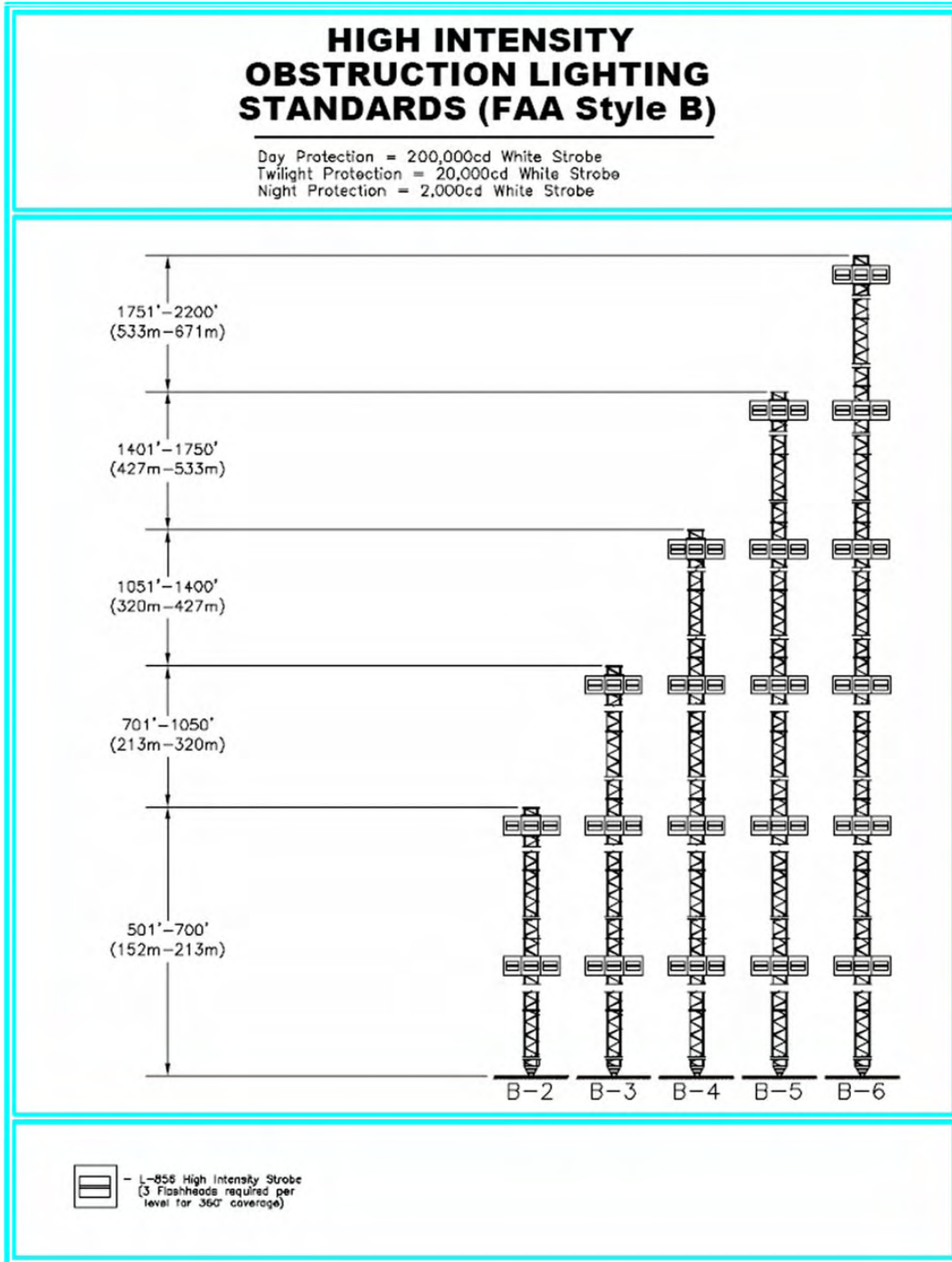


FIG 15

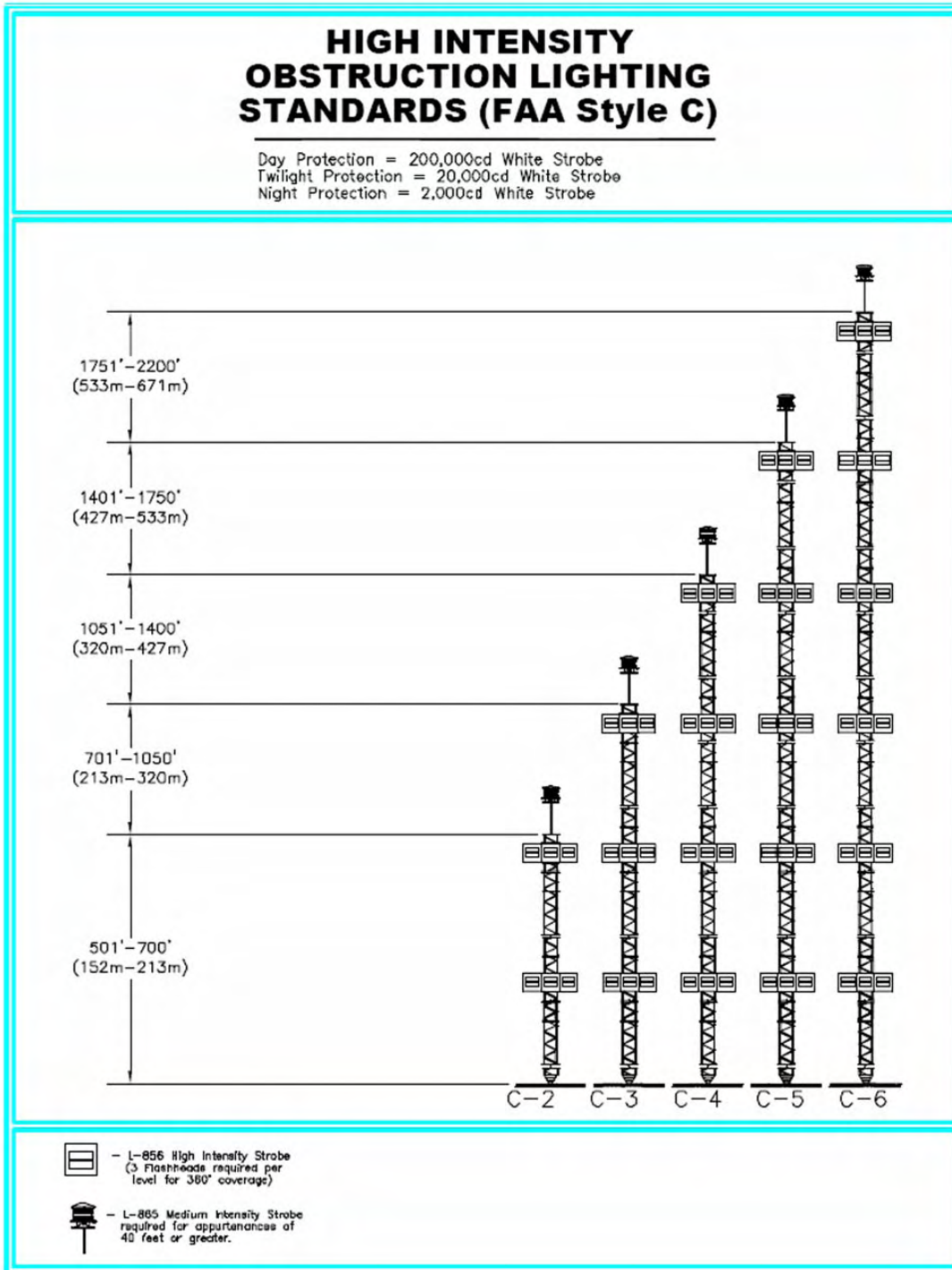


FIG 16

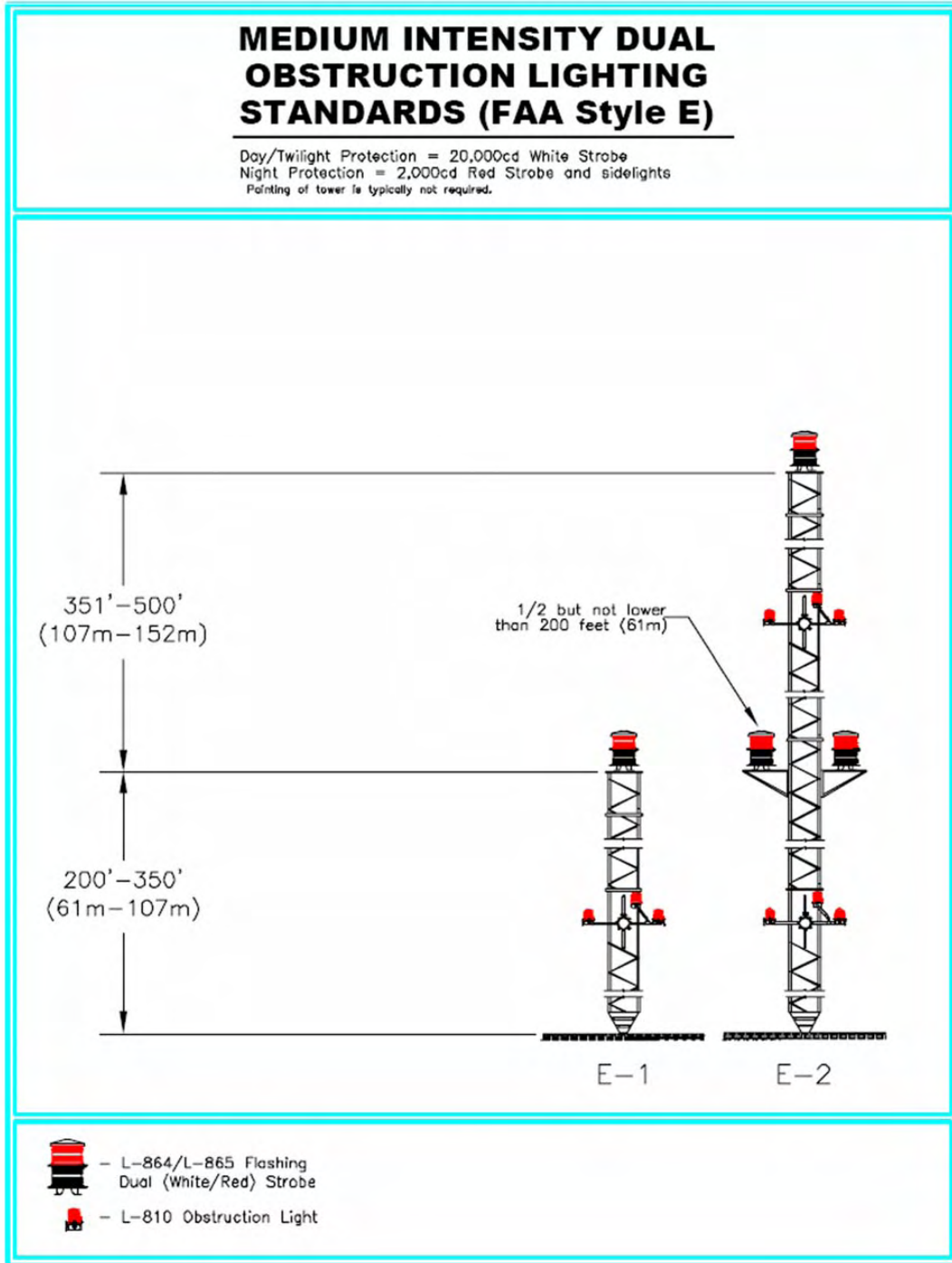


FIG 17



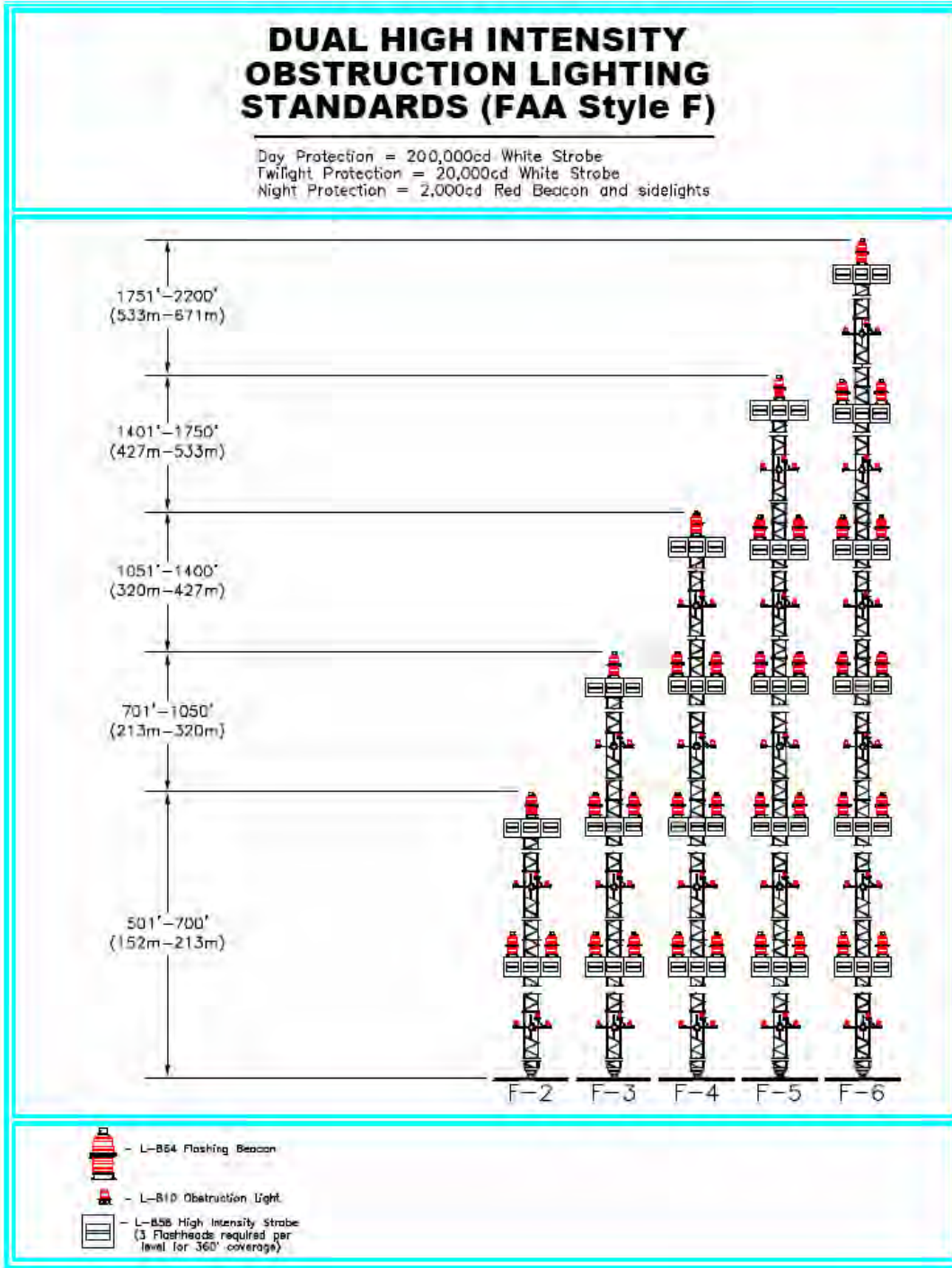


FIG 18

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**APPENDIX 2. Miscellaneous**

**1. RATIONALE FOR OBSTRUCTION LIGHT INTENSITIES.**

Sections 91.117, 91.119 and 91.155 of the FAR Part 91, General Operating and Flight Rules, prescribe aircraft speed restrictions, minimum safe altitudes, and basic visual flight rules (VFR) weather minimums for

governing the operation of aircraft, including helicopters, within the United States.

**2. DISTANCE VERSUS INTENSITIES.**

TBL 5 depicts the distance the various intensities can be seen under 1 and 3 statute miles meteorological visibilities:

**Distance/Intensity Table**

<b>Time Period</b>	<b>Meteorological Visibility Statute Miles</b>	<b>Distance Statute Miles</b>	<b>Intensity Candelas</b>
<b>Night</b>		<b>2.9 (4.7km)</b>	<b>1,500 (+/- 25%)</b>
	<b>3 (4.8km)</b>	<b>3.1 (4.9km)</b>	<b>2,000 (+/- 25%)</b>
		<b>1.4 (2.2km)</b>	<b>32</b>
<b>Day</b>		<b>1.5 (2.4km)</b>	<b>200,000</b>
	<b>1 (1.6km)</b>	<b>1.4 (2.2km)</b>	<b>100,000</b>
		<b>1.0 (1.6km)</b>	<b>20,000 (+/- 25%)</b>
<b>Day</b>		<b>3.0 (4.8km)</b>	<b>200,000</b>
	<b>3 (4.8km)</b>	<b>2.7 (4.3km)</b>	<b>100,000</b>
		<b>1.8 (2.9km)</b>	<b>20,000 (+/- 25%)</b>
<b>Twilight</b>	<b>1 (1.6km)</b>	<b>1.0 (1.6km) to 1.5 (2.4km)</b>	<b>20,000 (+/- 25%)?</b>
<b>Twilight</b>	<b>3 (4.8km)</b>	<b>1.8 (2.9km) to 4.2 (6.7km)</b>	<b>20,000 (+/- 25%)?</b>

*Note-*

1. DISTANCE CALCULATED FOR NORTH SKY ILLUMINANCE.

TBL 5

**3. CONCLUSION.**

Pilots of aircraft travelling at 165 knots (190 mph/306kph) or less should be able to see obstruction lights in sufficient time to avoid the structure by at least 2,000 feet (610m) horizontally under all conditions of operation, provided the pilot is operating in accordance with FAR Part 91. Pilots operating between 165 knots (190 mph/303 km/h) and 250 knots (288 mph/463 kph) should be able to see the obstruction lights unless the weather deteriorates to 3 statute miles (4.8 kilometers) visibility at night, during which time period 2,000 candelas would be required to see the lights at 1.2 statute miles (1.9km). A higher intensity, with 3 statute miles (4.8 kilometers) visibility at night, could generate a residential annoyance factor. In addition, aircraft in these speed ranges can normally be expected to operate under instrument flight rules (IFR) at night when the visibility is 1 statute mile (1.6 kilometers).

**4. DEFINITIONS.**

a. Flight Visibility. The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

*Reference-*

AIRMAN'S INFORMATION MANUAL  
PILOT/CONTROLLER GLOSSARY.

b. Meteorological Visibility. A term that denotes the greatest distance, expressed in statute miles, that selected objects (visibility markers) or lights of moderate intensity (25 candelas) can be seen and identified under specified conditions of observation.

**5. LIGHTING SYSTEM CONFIGURATION.**

- a. *Configuration A.* Red lighting system.
- b. *Configuration B.* High Intensity White Obstruction Lights (including appurtenance lighting).
- c. *Configuration C.* Dual Lighting System - High Intensity White & Red (including appurtenance lighting).

d. *Configuration D.* Medium Intensity White Lights (including appurtenance lighting).

e. *Configuration E.* Dual Lighting Systems - Medium Intensity White & Red (including appurtenance lighting).

*Example-*  
"CONFIGURATION B 3" DENOTES A HIGH INTENSITY LIGHTING SYSTEM WITH THREE LEVELS OF LIGHT.

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***APPENDIX K***  
***AIR QUALITY***

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**Table 1 - AIRCRAFT EMISSION FACTORS**

Aircraft	# of Engines	Aircraft Engine	Power Setting	Fuel Flow rate Lb/HR	Pounds/1000 pounds Fuel					kg/lb fuel	g/lb fuel		
					THC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	
KC-135R	4	F108-CF-100	Idle	1,136	0.92	27.19	3.94	1.06	9.08	1.41	0.04	0.05	
			Approach	2,547	0.04	6.39	6.96	1.06	1.55	1.41	0.04	0.05	
			Intermediate	5,650	0.03	1.61	13.53	1.06	0.65	1.41	0.04	0.05	
			<b>Military</b>	<b>6,458</b>	<b>0.03</b>	<b>0.63</b>	<b>15.28</b>	<b>1.06</b>	<b>1.59</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>6,458</b>	<b>0.03</b>	<b>0.63</b>	<b>15.28</b>	<b>1.06</b>	<b>1.59</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
F-15 A/B/C/D	1	F100-PW-100	Idle	1,097	8.60	35.29	4.38		2.06				
			Approach	2,746	0.16	3.49	12.33		2.63				
			Intermediate	7,617	0.14	0.91	30.89		2.06				
			<b>Military</b>	<b>10,104</b>	<b>0.28</b>	<b>0.90</b>	<b>39.44</b>		<b>1.33</b>				
F-15 C/D/E	1	F100-PW-200	Idle	54,074	0.05	9.57	6.62		1.15				
			Approach	1,016	8.26	26.61	4.99	1.06	2.06	1.41	0.04	0.05	
			Intermediate	3,135	17.62	1.38	13.82	1.06	2.63	1.41	0.04	0.05	
			<b>Military</b>	<b>5,406</b>	<b>4.97</b>	<b>0.49</b>	<b>27.60</b>	<b>1.06</b>	<b>2.06</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
F-15 E	1	F100-PW-229	Idle	8,717	3.47	0.86	39.12	1.06	1.33	1.41	0.04	0.05	
			Approach	40,247	0.32	9.47	7.03	1.06	1.15	1.41	0.04	0.05	
			Intermediate	1,087	0.38	10.16	3.80		2.06				
			<b>Military</b>	<b>3,098</b>	<b>0.21</b>	<b>1.17</b>	<b>15.08</b>		<b>2.63</b>				
				<b>5,838</b>	<b>0.30</b>	<b>0.15</b>	<b>17.53</b>		<b>2.06</b>				
				<b>11,490</b>	<b>0.54</b>	<b>0.66</b>	<b>57.65</b>		<b>1.33</b>				
				<b>20,793</b>	<b>16.26</b>	<b>76.62</b>	<b>50.92</b>		<b>1.15</b>				
				<b>Average<sup>2</sup></b>	<b>10,104</b>	<b>1.43</b>	<b>0.81</b>	<b>45.40</b>	<b>1.06</b>	<b>1.33</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>
F-16A/B	1	F100-PW-200	Idle	1,016	8.26	26.61	4.99	1.06	2.06	1.41	0.04	0.05	
			Approach	3,135	17.62	1.38	13.82	1.06	2.63	1.41	0.04	0.05	
			Intermediate	5,406	4.97	0.49	27.60	1.06	2.06	1.41	0.04	0.05	
			<b>Military</b>	<b>8,717</b>	<b>3.47</b>	<b>0.86</b>	<b>39.12</b>	<b>1.06</b>	<b>1.33</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>40,247</b>	<b>0.32</b>	<b>9.47</b>	<b>7.03</b>	<b>1.06</b>	<b>1.15</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
F-16C/D	1	F110-GE-129	Idle	1,036	2.64	34.58	3.19	1.06	2.61	1.41	0.04	0.05	
			Approach	4,956	0.05	3.85	11.60	1.06	1.37	1.41	0.04	0.05	
			Intermediate	7,136	0.01	2.49	17.33	1.06	0.57	1.41	0.04	0.05	
			<b>Military</b>	<b>9,985</b>	<b>0.54</b>	<b>2.42</b>	<b>27.13</b>	<b>1.06</b>	<b>0.14</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>16,826</b>	<b>64.80</b>	<b>104.60</b>	<b>15.08</b>	<b>1.06</b>	<b>3.34</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
F-16N	1	F110-GE-100	Idle	1,044	2.10	31.06	4.33	1.06	1.84	1.41	0.04	0.05	
			Approach	4,128	0.36	4.00	10.87	1.06	0.95	1.41	0.04	0.05	
			Intermediate	6,598	0.19	2.20	18.25	1.06	0.57	1.41	0.04	0.05	
			<b>Military</b>	<b>9,974</b>	<b>0.62</b>	<b>2.05</b>	<b>30.35</b>	<b>1.06</b>	<b>0.14</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>16,374</b>	<b>69.33</b>	<b>97.50</b>	<b>15.55</b>	<b>1.06</b>	<b>3.34</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
			Idle	1,032	4.33	30.75	4.17	1.06	2.17	1.41	0.04	0.05	
			Approach	4,073	6.01	3.08	12.10	1.06	1.65	1.41	0.04	0.05	
			Intermediate	6,380	1.72	1.73	21.06	1.06	1.07	1.41	0.04	0.05	
			<b>Military</b>	<b>9,559</b>	<b>1.54</b>	<b>1.78</b>	<b>32.20</b>	<b>1.06</b>	<b>0.54</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>24,482</b>	<b>44.82</b>	<b>70.52</b>	<b>12.55</b>	<b>1.06</b>	<b>2.61</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>Average<sup>2</sup></b>	<b>9,559</b>	<b>1.54</b>	<b>1.78</b>	<b>32.20</b>	<b>1.06</b>	<b>0.54</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>
B-1B	4	F101-GE-102	Idle	1,117		24.47	4.10	1.06	2.17	1.41	0.04	0.05	
			Approach	4,533	0.14	1.03	9.16	1.06	4.23	1.41	0.04	0.05	
			Intermediate	6,557	0.13	0.85	13.15	1.06	1.35	1.41	0.04	0.05	
			<b>Military</b>	<b>7,828</b>	<b>0.11</b>	<b>0.83</b>	<b>12.83</b>	<b>1.06</b>	<b>1.68</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>15,314</b>	<b>61.82</b>	<b>43.47</b>	<b>16.91</b>	<b>1.06</b>	<b>2.86</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>7,828</b>	<b>0.11</b>	<b>0.83</b>	<b>12.83</b>	<b>1.06</b>	<b>1.68</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
B-2	4	F118-GE-100	Idle	1,097	0.59	20.98	4.30	1.06	1.25	1.41	0.04	0.05	
			Approach	3,773	0.87	2.02	11.09	1.06	4.47	1.41	0.04	0.05	
			Intermediate	6,350	ND	0.84	18.01	1.06	1.78	1.41	0.04	0.05	
			<b>Military</b>	<b>10,887</b>	<b>ND</b>	<b>0.65</b>	<b>33.12</b>	<b>1.06</b>	<b>1.64</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>10,887</b>	<b>ND</b>	<b>0.65</b>	<b>33.12</b>	<b>1.06</b>	<b>1.64</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
B-52H	8	TF33-P-3	Idle	900	90.91	95.06	1.39	1.06	4.98	1.41	0.04	0.05	
			Approach	3,800	1.37	5.24	6.37	1.06	3.55	1.41	0.04	0.05	
			Intermediate	6,240	1.50	2.11	7.88	1.06	3.15	1.41	0.04	0.05	
			<b>Military</b>	<b>7,440</b>	<b>0.55</b>	<b>1.19</b>	<b>12.08</b>	<b>1.06</b>	<b>3.67</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	
				<b>7,440</b>	<b>0.55</b>	<b>1.19</b>	<b>12.08</b>	<b>1.06</b>	<b>3.67</b>	<b>1.41</b>	<b>0.04</b>	<b>0.05</b>	

**Notes:**

- (1) Unless otherwise cited, all data on this page are from Table 3-3 of "Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations" IERA-RS-BR-SR-2001-0010, AF IERA, Brooks Air Force Base TX, January 2002, except SO2 emission factors obtained from AFCEC January 2013.
- (2) Military Mode Averages were not taken from the AF IERA
- (3) JP-8 (jet fuel density) - 6.8 lb/gallon

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**Table 2A -Baseline - Airspace Operations**

AirspaceUnit	Aircraft	Annual Hours of Operation within Airspace	Altitude AGL (Feet)			Total Hours
			500 - 1,000	1,000 - 2,000	2,000 - 5,000	
Powder River A MOA	B-1	125.0	25.0	56.3	25.0	106.3
	B-52	-	-	0.0	-	0.0
	Tankers <sup>1</sup>	-	-	-	-	-
	Transient	5.0	0.9	0.9	-	1.8
Powder River B MOA	B-1	125.0	25.0	56.3	25.0	106.3
	B-52	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-
	Transient	5.0	0.9	0.9	-	1.8

**Table 2B - Modified Alternative A - Airspace Operations**

AirspaceUnit	Aircraft	Annual Hours of Operation within Airspace	Altitude AGL (Feet)			Total Hours
			500 - 1,000	1,000 - 2,000	2,000 - 5,000	
Powder River 1 MOA	B-1	419.0	21.0	47.2	21.0	89.2
	B-52	33.0	-	2.3	0.4	2.7
	Tankers <sup>1</sup>	69.0	-	-	-	-
	Transient	36.0	2.0	2.0	-	4.0
Powder River 2 MOA	B-1	779.7	39.0	87.7	39.0	165.7
	B-52	97.3	-	13.8	2.4	16.2
	Tankers <sup>1</sup>	5.6	-	-	-	-
	Transient	39.9	2.2	2.2	-	4.3
Powder River 3 MOA	B-1	389.2	19.5	43.8	19.5	82.8
	B-52	25.8	-	2.3	0.4	2.7
	Tankers <sup>1</sup>	3.7	-	-	-	-
	Transient	25.1	1.4	1.4	-	2.7
Powder River 4 MOA	B-1	405.6	-	-	-	-
	B-52	92.1	-	-	-	-
	Tankers <sup>1</sup>	68.6	-	-	-	-
	Transient	31.2	-	-	-	-
GAP A MOA	B-1	13.0	0.7	1.5	0.7	2.8
	B-52	2.9	-	-	-	-
	Tankers <sup>1</sup>	0.6	-	-	-	-
	Transient	4.9	0.3	0.3	-	0.5
GAP B MOA	B-1	17.6	0.9	2.0	0.9	3.7
	B-52	4.0	-	-	-	-
	Tankers <sup>1</sup>	0.8	-	-	-	-
	Transient	6.6	0.4	0.4	-	0.7
GAP C MOA	B-1	9.1	0.5	1.0	0.5	1.9
	B-52	2.1	-	-	-	-
	Tankers <sup>1</sup>	0.4	-	-	-	-
	Transient	3.4	0.2	0.2	-	0.4

Notes: 1. Tankers = KC-135

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**Table 2C - Alternative B - Airspace Operations**

AirspaceUnit	Aircraft	Annual Hours of Operation within Airspace	Altitude AGL (Feet)			Total Hours
			500 - 1,000	1,000 - 2,000	2,000 - 5,000	
Powder River 2 MOA	B-1	793.6	39.7	89.3	39.7	168.6
	B-52	247.3	-	41.4	7.3	48.7
	Tankers <sup>1</sup>	5.6	-	-	-	-
	Transient	44.1	2.4	2.4	-	4.8
Powder River 3 MOA	B-1	437.2	21.9	49.2	21.9	92.9
	B-52	38.3	-	4.6	0.8	5.4
	Tankers <sup>1</sup>	3.7	-	-	-	-
	Transient	28.2	1.5	1.5	-	3.0
Powder River 4 MOA	B-1	455.9	22.8	51.3	22.8	96.9
	B-52	154.6	-	25.3	4.4	29.7
	Tankers <sup>1</sup>	68.6	-	-	-	-
	Transient	35.2	1.9	1.9	-	3.8
GAP B MOA	B-1	20.1	1.0	2.3	1.0	4.3
	B-52	4.0	-	-	-	-
	Tankers <sup>1</sup>	0.8	-	-	-	-
	Transient	7.6	0.4	0.4	-	0.8
GAP C MOA	B-1	10.4	0.5	1.2	0.5	2.2
	B-52	2.1	-	-	-	-
	Tankers <sup>1</sup>	0.4	-	-	-	-
	Transient	3.9	0.2	0.2	-	0.4

**Table 2D - Alternative C - Airspace Operations**

AirspaceUnit	Aircraft	Annual Hours of Operation within Airspace	Altitude AGL (Feet)			Total Hours
			500 - 1,000	1,000 - 2,000	2,000 - 5,000	
Powder River 1 MOA	B-1	469.3	23.5	52.8	23.5	99.7
	B-52	158.2	-	25.3	4.4	29.7
	Tankers <sup>1</sup>	68.6	-	-	-	-
	Transient	39.2	2.1	2.1	-	4.2
Powder River 2 MOA	B-1	791.3	45.0	101.3	45.0	191.3
	B-52	247.3	-	41.4	7.3	48.7
	Tankers <sup>1</sup>	5.6	-	-	-	-
	Transient	43.3	2.3	2.3	-	4.7
Powder River 3 MOA	B-1	435.8	21.8	49.0	21.8	92.6
	B-52	38.3	-	4.6	0.8	5.4
	Tankers <sup>1</sup>	3.7	-	-	-	-
	Transient	27.7	1.5	1.5	-	3.0
GAP A MOA	B-1	14.5	0.7	1.6	0.7	3.1
	B-52	2.9	-	-	-	-
	Tankers <sup>1</sup>	0.6	-	-	-	-
	Transient	5.4	0.3	0.3	-	0.6
GAP B MOA	B-1	19.7	1.0	2.2	1.0	4.2
	B-52	4.0	-	-	-	-
	Tankers <sup>1</sup>	0.8	-	-	-	-
	Transient	7.4	0.4	0.4	-	0.8

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**Table 3 - Baseline Airspace Emissions**

AirspaceUnit	Aircraft	Total Hours	TONS PER YEAR						METRIC TONS PER YEAR			
			VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Powder River A MOA	B-1	106.3	0.18	1.38	21.34	1.76	2.79	2.79	4,682.05	0.13	0.15	4,731.84
	B-52	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.45
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	1.8	0.01	0.02	0.28	0.01	0.00	0.00	79.32	0.00	0.00	80.16
<b>AIRSPACE TOTAL</b>			<b>0.20</b>	<b>1.40</b>	<b>21.62</b>	<b>1.77</b>	<b>2.80</b>	<b>2.80</b>	<b>4,761.81</b>	<b>0.13</b>	<b>0.15</b>	<b>4,812.45</b>
Powder River B MOA	B-1	106.3	0.18	1.38	21.34	1.76	2.79	2.79	4,682.05	0.13	0.15	4,731.84
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	1.8	0.01	0.02	0.28	0.01	0.00	0.00	79.32	0.00	0.00	80.16
<b>AIRSPACE TOTAL</b>			<b>0.18</b>	<b>1.38</b>	<b>21.34</b>	<b>1.76</b>	<b>2.79</b>	<b>4,761.37</b>	<b>0.13</b>	<b>0.15</b>	<b>4,812.00</b>	
<b>TOTAL BASELINE EMISSIONS</b>			<b>0.38</b>	<b>2.78</b>	<b>42.96</b>	<b>3.54</b>	<b>5.59</b>	<b>5.59</b>	<b>9,523.18</b>	<b>0.27</b>	<b>0.31</b>	<b>9,624.45</b>

Note: CH4 has a GWP of 21 and N2O has a GWP of 310

**Table 4A - Modified Alternative A Airspace Emissions**

AirspaceUnit	Aircraft	Total Hours	TONS PER YEAR						METRIC TONS PER YEAR			
			VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Powder River 1 MOA	B-1	89.2	0.15	1.16	17.92	1.48	2.35	2.35	3,930.72	0.11	0.13	3,972.52
	B-52	2.7	0.04	0.10	0.97	0.09	0.29	0.29	118.98	0.00	0.00	120.24
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	4.0	0.03	0.03	0.62	0.02	0.01	0.01	176.27	0.00	0.01	178.14
<b>AIRSPACE TOTAL</b>			<b>0.23</b>	<b>1.29</b>	<b>19.50</b>	<b>1.59</b>	<b>2.65</b>	<b>2.65</b>	<b>4,225.96</b>	<b>0.12</b>	<b>0.14</b>	<b>4,270.90</b>
Powder River 2 MOA	B-1	165.7	0.29	2.15	33.28	2.75	4.36	4.36	7,300.47	0.21	0.24	7,378.11
	B-52	16.2	0.27	0.57	5.82	0.51	1.77	1.77	713.87	0.02	-	714.30
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	4.3	0.03	0.04	0.66	0.02	0.01	0.01	189.49	0.01	0.01	191.50
<b>AIRSPACE TOTAL</b>			<b>0.58</b>	<b>2.76</b>	<b>39.76</b>	<b>3.28</b>	<b>6.14</b>	<b>6.14</b>	<b>8,203.83</b>	<b>0.23</b>	<b>0.24</b>	<b>8,283.90</b>
Powder River 3 MOA	B-1	82.8	0.14	1.08	16.63	1.37	2.18	2.18	3,648.69	0.10	0.12	3,687.49
	B-52	2.7	0.04	0.10	0.97	0.09	0.29	0.29	118.98	0.00	0.00	120.24
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	2.7	0.02	0.02	0.42	0.01	0.01	0.01	118.98	0.00	0.00	120.24
<b>AIRSPACE TOTAL</b>			<b>0.21</b>	<b>1.19</b>	<b>18.02</b>	<b>1.47</b>	<b>2.48</b>	<b>2.48</b>	<b>3,886.65</b>	<b>0.11</b>	<b>0.13</b>	<b>3,927.98</b>
Powder River 4 MOA	B-1	-	-	-	-	-	-	-	-	-	-	-
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	-	-	-	-	-	-	-	-	-	-	-
<b>AIRSPACE TOTAL</b>			<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	
GAP A MOA	B-1	2.8	0.00	0.04	0.55	0.05	0.07	0.07	121.62	0.00	0.00	122.92
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.5	0.00	0.00	0.08	0.00	0.00	0.00	22.91	0.00	0.00	23.16
<b>AIRSPACE TOTAL</b>			<b>0.01</b>	<b>0.04</b>	<b>0.63</b>	<b>0.05</b>	<b>0.07</b>	<b>0.07</b>	<b>144.54</b>	<b>0.00</b>	<b>0.00</b>	<b>146.07</b>
GAP B MOA	B-1	3.7	0.01	0.05	0.75	0.06	0.10	0.10	164.81	0.00	0.01	166.56
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.7	0.01	0.01	0.11	0.00	0.00	0.00	31.73	0.00	0.00	32.07
<b>AIRSPACE TOTAL</b>			<b>0.01</b>	<b>0.05</b>	<b>0.86</b>	<b>0.07</b>	<b>0.10</b>	<b>0.10</b>	<b>196.54</b>	<b>0.01</b>	<b>0.01</b>	<b>198.63</b>
GAP C MOA	B-1	1.9	0.00	0.03	0.39	0.03	0.05	0.05	85.49	0.00	0.00	86.40
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.4	0.00	0.00	0.06	0.00	0.00	0.00	15.86	0.00	0.00	16.03
<b>AIRSPACE TOTAL</b>			<b>0.01</b>	<b>0.03</b>	<b>0.45</b>	<b>0.03</b>	<b>0.05</b>	<b>0.05</b>	<b>101.35</b>	<b>0.00</b>	<b>0.00</b>	<b>102.43</b>
<b>TOTAL ALTERNATIVE A EMISSIONS</b>			<b>1.04</b>	<b>5.37</b>	<b>79.23</b>	<b>6.49</b>	<b>11.49</b>	<b>11.49</b>	<b>16,758.87</b>	<b>0.47</b>	<b>0.52</b>	<b>16,929.92</b>

Note: CH4 has a GWP of 21 and N2O has a GWP of 310

**Table 4B - Alternative B Airspace Emissions**

AirspaceUnit	Aircraft	Total Hours	TONS PER YEAR						METRIC TONS PER YEAR			
			VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Powder River 2 MOA	B-1	168.6	0.29	2.19	33.87	2.80	4.44	4.44	7,431.35	0.21	0.24	7,510.38
	B-52	48.7	0.80	1.72	17.49	1.53	5.31	5.31	2,143.83	0.06	0.07	2,166.63
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	4.8	0.04	0.04	0.73	0.02	0.01	0.01	209.76	0.01	0.01	211.99
<b>AIRSPACE TOTAL</b>			<b>1.12</b>	<b>3.95</b>	<b>52.10</b>	<b>4.36</b>	<b>9.76</b>	<b>9.76</b>	<b>9,784.93</b>	<b>0.28</b>	<b>0.32</b>	<b>9,888.99</b>
Powder River 3 MOA	B-1	92.9	0.16	1.21	18.66	1.54	2.44	2.44	4,094.20	0.12	0.13	4,137.74
	B-52	5.4	0.09	0.19	1.94	0.17	0.59	0.59	238.40	0.01	0.01	240.93
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	3.0	0.02	0.03	0.47	0.02	0.01	0.01	133.96	0.00	0.00	135.39
<b>AIRSPACE TOTAL</b>			<b>0.27</b>	<b>1.42</b>	<b>21.08</b>	<b>1.73</b>	<b>3.04</b>	<b>3.04</b>	<b>4,466.56</b>	<b>0.13</b>	<b>0.14</b>	<b>4,514.06</b>
Powder River 4 MOA	B-1	96.9	0.17	1.26	19.46	1.61	2.55	2.55	4,269.59	0.12	0.14	4,314.99
	B-52	29.7	0.49	1.05	10.69	0.94	3.25	3.25	1,310.09	0.04	0.04	1,324.02
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	3.8	0.03	0.03	0.58	0.02	0.01	0.01	167.45	0.00	0.01	169.23
<b>AIRSPACE TOTAL</b>			<b>0.68</b>	<b>2.34</b>	<b>30.73</b>	<b>2.57</b>	<b>5.81</b>	<b>5.81</b>	<b>5,747.13</b>	<b>0.16</b>	<b>0.19</b>	<b>5,808.25</b>
GAP B MOA	B-1	4.3	0.01	0.06	0.86	0.07	0.11	0.11	189.04	0.01	0.01	191.05
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.8	0.01	0.01	0.13	0.00	0.00	0.00	36.13	0.00	0.00	36.52
<b>AIRSPACE TOTAL</b>			<b>0.01</b>	<b>0.06</b>	<b>0.99</b>	<b>0.08</b>	<b>0.11</b>	<b>0.11</b>	<b>225.18</b>	<b>0.01</b>	<b>0.01</b>	<b>227.57</b>
GAP C MOA	B-1	2.2	0.00	0.03	0.44	0.04	0.06	0.06	97.39	0.00	0.00	98.42
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.4	0.00	0.00	0.06	0.00	0.00	0.00	18.51	0.00	0.00	18.70
<b>AIRSPACE TOTAL</b>			<b>0.01</b>	<b>0.03</b>	<b>0.51</b>	<b>0.04</b>	<b>0.06</b>	<b>0.06</b>	<b>115.89</b>	<b>0.00</b>	<b>0.00</b>	<b>117.13</b>
<b>TOTAL ALTERNATIVE B EMISSIONS</b>			<b>2.09</b>	<b>7.82</b>	<b>105.40</b>	<b>8.76</b>	<b>18.78</b>	<b>18.78</b>	<b>20,339.70</b>	<b>0.57</b>	<b>0.66</b>	<b>20,556.00</b>

Note: CH4 has a GWP of 21 and N2O has a GWP of 310



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**Table 4C - Alternative C Airspace Emissions**

AirspaceUnit	Aircraft	Total Hours	TONS PER YEAR						METRIC TONS PER YEAR			
			VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Powder River 1 MOA	B-1	99.7	0.17	1.30	20.03	1.66	2.62	2.62	4,395.18	0.12	0.14	4,441.92
	B-52	29.7	0.49	1.05	10.69	0.94	3.25	3.25	1,310.09	0.04	0.04	1,324.02
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	4.2	0.03	0.04	0.65	0.02	0.01	0.01	186.84	0.01	0.01	188.83
<b>AIRSPACE TOTAL</b>			<b>0.69</b>	<b>2.38</b>	<b>31.37</b>	<b>2.61</b>	<b>5.88</b>	<b>5.88</b>	<b>5,892.11</b>	<b>0.17</b>	<b>0.19</b>	<b>5,954.77</b>
Powder River 2 MOA	B-1	191.3	0.33	2.49	38.42	3.17	5.03	5.03	8,427.69	0.24	0.27	8,517.31
	B-52	48.7	0.80	1.72	17.49	1.53	5.31	5.31	2,143.83	0.06	0.07	2,166.63
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	4.7	0.03	0.04	0.72	0.02	0.01	0.01	206.23	0.01	0.01	208.42
<b>AIRSPACE TOTAL</b>			<b>1.16</b>	<b>4.25</b>	<b>56.63</b>	<b>4.73</b>	<b>10.36</b>	<b>10.36</b>	<b>10,777.75</b>	<b>0.30</b>	<b>0.35</b>	<b>10,892.36</b>
Powder River 3 MOA	B-1	92.6	0.16	1.20	18.60	1.54	2.44	2.44	4,080.98	0.12	0.13	4,124.38
	B-52	5.4	0.09	0.19	1.94	0.17	0.59	0.59	238.40	0.01	0.01	240.93
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	3.0	0.02	0.03	0.46	0.02	0.01	0.01	131.32	0.00	0.00	132.71
<b>AIRSPACE TOTAL</b>			<b>0.27</b>	<b>1.42</b>	<b>21.01</b>	<b>1.72</b>	<b>3.03</b>	<b>3.03</b>	<b>4,450.70</b>	<b>0.13</b>	<b>0.14</b>	<b>4,498.03</b>
GAP A MOA	B-1	3.1	0.01	0.04	0.62	0.05	0.08	0.08	136.17	0.00	0.00	137.61
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.6	0.00	0.00	0.09	0.00	0.00	0.00	25.56	0.00	0.00	25.83
<b>AIRSPACE TOTAL</b>			<b>0.01</b>	<b>0.05</b>	<b>0.71</b>	<b>0.05</b>	<b>0.08</b>	<b>0.08</b>	<b>161.72</b>	<b>0.00</b>	<b>0.01</b>	<b>163.44</b>
GAP B MOA	B-1	4.2	0.01	0.05	0.84	0.07	0.11	0.11	185.08	0.01	0.01	187.05
	B-52	-	-	-	-	-	-	-	-	-	-	-
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.8	0.01	0.01	0.12	0.00	0.00	0.00	35.25	0.00	0.00	35.63
<b>AIRSPACE TOTAL</b>			<b>0.01</b>	<b>0.06</b>	<b>0.97</b>	<b>0.07</b>	<b>0.11</b>	<b>0.11</b>	<b>220.33</b>	<b>0.01</b>	<b>0.01</b>	<b>222.67</b>
<b>TOTAL ALTERNATIVE C EMISSIONS</b>			<b>2.14</b>	<b>8.16</b>	<b>110.68</b>	<b>9.20</b>	<b>19.47</b>	<b>19.47</b>	<b>21,502.61</b>	<b>0.61</b>	<b>0.70</b>	<b>21,731.28</b>

Notes:

1. Tankers = KC-135

2. Transient: Average Emission Factors B-1, B-2, B-52, KC-135, F-15, F-16

Note: CH<sub>4</sub> has a GWP of 21 and N<sub>2</sub>O has a GWP of 310

**Table 5 - Modified Alternative A Emissions - Powder River 1B and 1D MOA/ATCAA Airspaces**

AirspaceUnit	Aircraft	Total Hours	TONS PER YEAR						METRIC TONS PER YEAR			
			VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Powder River 1B MOA	B-1	21.2	0.04	0.27	4.25	0.35	0.56	0.56	932	0.03	0.03	942
	B-52	0.7	0.01	0.02	0.24	0.02	0.07	0.07	30	0.00	0.00	30
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	0.8	0.01	0.01	0.13	0.00	0.00	0.00	36	0.00	0.00	37
<b>AIRSPACE TOTAL</b>			<b>0.05</b>	<b>0.31</b>	<b>4.62</b>	<b>0.38</b>	<b>0.63</b>	<b>0.63</b>	<b>998</b>	<b>0.03</b>	<b>0.03</b>	<b>1,009</b>
<b>Emissions within Rosebud County</b>			<b>0.04</b>	<b>0.22</b>	<b>3.37</b>	<b>0.27</b>	<b>0.46</b>	<b>0.46</b>	<b>728.62</b>	<b>0.02</b>	<b>0.02</b>	<b>736.36</b>
Powder River 1D MOA	B-1	48.1	0.08	0.63	9.66	0.80	1.27	1.27	2,120	0.06	0.07	2,142
	B-52	1.5	0.02	0.05	0.52	0.05	0.16	0.16	64	0.00	0.00	65
	Tankers <sup>1</sup>	-	-	-	-	-	-	-	-	-	-	-
	Transient <sup>2</sup>	2.2	0.02	0.02	0.33	0.01	0.01	0.01	95	0.00	0.00	96
<b>AIRSPACE TOTAL</b>			<b>0.12</b>	<b>0.69</b>	<b>10.52</b>	<b>0.85</b>	<b>1.43</b>	<b>1.43</b>	<b>2,279</b>	<b>0.06</b>	<b>0.07</b>	<b>2,303</b>
<b>Emissions within Rosebud County</b>			<b>0.04</b>	<b>0.21</b>	<b>3.15</b>	<b>0.26</b>	<b>0.43</b>	<b>0.43</b>	<b>683.60</b>	<b>0.02</b>	<b>0.02</b>	<b>690.87</b>
<b>Emissions within Sheridan County</b>			<b>0.01</b>	<b>0.05</b>	<b>0.78</b>	<b>0.06</b>	<b>0.11</b>	<b>0.11</b>	<b>169.47</b>	<b>0.00</b>	<b>0.01</b>	<b>171.27</b>
<b>Total Emissions within Rosebud County</b>			<b>0.08</b>	<b>0.43</b>	<b>6.53</b>	<b>0.53</b>	<b>0.89</b>	<b>0.89</b>	<b>1,412.22</b>	<b>0.04</b>	<b>0.05</b>	<b>1,427.23</b>
<b>Emissions over N. Cheyenne Indian Reservation</b>			-	-	-	-	-	-	-	-	-	-
Big Horn County		4,925	-	-	4,995	602	-	-	-	-	-	17,997
Rosebud County		1,782	-	-	27,562	15,510	10,551	-	-	-	-	-
Combined Counties		6,707	-	-	32,557	16,112	28,548	-	-	-	-	-
<b>Airspace PR 1D Fraction of Combined Counties</b>			-	-	-	-	-	-	-	-	-	-
<b>Airspace PR 1D % of Combined Counties</b>			-	-	-	-	-	-	-	-	-	-

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**MJU Flare Emission Factors**

Table 15.8.16-1 EMISSION FACTORS FOR THE USE OF DODIC L410,  
M206 AIRCRAFT COUNTERMEASURE FLARE - CARBON DIOXIDE, CRITERIA POLLUTANTS,  
TOTAL NONMETHANE HYDROCARBONS, AND TOTAL SUSPENDED PARTICULATEa  
EMISSION FACTOR RATING: B (except as noted)

CASRNb	Pollutant	lb per item	lb per lb NEWc
124-38-9	CO2	0.011	0.034
630-08-0	Carbon monoxide (CO)	0.001	0.004
--	Oxides of Nitrogen (NOx)	0.000	0.000
--	PM-2.5	0.006	0.020
--	PM-10	0.006	0.020
7446-05-09	Sulfur dioxide (SO2)	0.000	0.000
--	TNMHC	0.000	0.001
12789-66-1	TSPf	0.009	0.028

M206 was used for approximation to MJU Flares

<http://www.globalsecurity.org/military/systems/aircraft/systems/m206.htm>

**Chaff Emission Factor**

Source: Air Force. 1997. Environmental Effects of Self-Protection Chaff and Flares.  
Prepared for Headquarters Air Combat Command, Langley AFB, Virginia

		95 gm per item	
		Chaffs	Flares
<b>Existing</b>	Powder River A MOA	N/A	N/A
	Powder River B MOA	N/A	N/A
	Gateway ATCAA	N/A	N/A
	Black Hills ATCAA	N/A	N/A
	<b>TOTAL</b>	N/A	N/A
<b>Alternative A</b>	Powder River 1 MOA/ATCCA	8300	820
	Powder River 2 MOA/ATCAA	11000	1100
	Powder River 3 MOA/ATCAA	4200	420
	Powder River 4 MOA/ATCAA	5500	550
	Gap A MOA/ATCAA	200	20
	Gap B MOA/ATCAA	260	30
	Gap C MOA/ATCAA	140	10
	Gap B Extension MOA/ATCAA		
	Gateway ATCAA	3400	350
	<b>TOTAL</b>	<b>33,000</b>	<b>3,300</b>
<b>Alternative B</b>	Powder River 1 MOA/ATCCA	4004	400
	Powder River 2 MOA/ATCAA	11489	1149
	Powder River 3 MOA/ATCAA	4574	457
	Powder River 4 MOA/ATCAA	5850	585
	Gap A MOA/ATCAA	131	13
	Gap B MOA/ATCAA	291	29
	Gap C MOA/ATCAA	150	15
	Gap B Extension MOA/ATCAA		
	Gateway ATCAA	3541	354
	<b>TOTAL</b>	<b>30,030</b>	<b>3,002</b>
<b>Alternative C</b>	Powder River 1 MOA/ATCCA	6055	606
	Powder River 2 MOA/ATCAA	11464	1146
	Powder River 3 MOA/ATCAA	4559	456
	Powder River 4 MOA/ATCAA	3833	383
	Gap A MOA/ATCAA	211	21
	Gap B MOA/ATCAA	287	29
	Gap C MOA/ATCAA	90	9
	Gap B Extension MOA/ATCAA		
	Gateway ATCAA	3531	353
	<b>TOTAL</b>	<b>30,030</b>	<b>3,003</b>

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**Table 6 - Alternative A Chaff and Flare Emissions**

Emissions by Area (Alternative A) Pounds/year							
	VOC/TNMHC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Powder River A MOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Powder River B MOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gateway ATCAA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Black Hills ATCAA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Powder River 1 MOA/ATCCA	0.33	1.07	0.11	0.01	0.87	0.87	9.02
Powder River 2 MOA/ATCAA	0.44	1.43	0.14	0.01	1.16	1.16	12.10
Powder River 3 MOA/ATCAA	0.17	0.55	0.05	0.00	0.44	0.44	4.62
Powder River 4 MOA/ATCAA	0.22	0.72	0.07	0.00	0.58	0.58	6.05
Gap A MOA/ATCAA	0.01	0.03	0.00	0.00	0.02	0.02	0.22
Gap B MOA/ATCAA	0.01	0.04	0.00	0.00	0.03	0.03	0.33
Gap C MOA/ATCAA	0.00	0.01	0.00	0.00	0.01	0.01	0.11
Gateway ATCAA	0.14	0.46	0.05	0.00	0.36	0.36	3.85
<b>Total</b>	<b>1.32</b>	<b>4.29</b>	<b>0.43</b>	<b>0.03</b>	<b>3.47</b>	<b>3.47</b>	<b>36.30</b>

**Table 7 - Alternative B Chaff and Flare Emissions**

Emissions by Area (Alternative B) tons/year							
	VOC/TNMHC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Powder River A MOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Powder River B MOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gateway ATCAA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Black Hills ATCAA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Powder River 1 MOA/ATCCA	0.16	0.52	0.05	0.00	2.90	2.90	4.40
Powder River 2 MOA/ATCAA	0.46	1.49	0.15	0.01	8.33	8.33	12.64
Powder River 3 MOA/ATCAA	0.18	0.59	0.06	0.00	3.31	3.31	5.03
Powder River 4 MOA/ATCAA	0.23	0.76	0.08	0.00	4.24	4.24	6.44
Gap A MOA/ATCAA	0.01	0.02	0.00	0.00	0.09	0.09	0.14
Gap B MOA/ATCAA	0.01	0.04	0.00	0.00	0.21	0.21	0.32
Gap C MOA/ATCAA	0.01	0.02	0.00	0.00	0.11	0.11	0.17
Gateway ATCAA	0.14	0.46	0.05	0.00	2.57	2.57	3.89
<b>Total (lbs/yr)</b>	<b>1.20</b>	<b>3.90</b>	<b>0.39</b>	<b>0.02</b>	<b>21.76</b>	<b>21.76</b>	<b>33.02</b>

**Table 8 - Alternative C Chaff and Flare Emissions**

Emissions by Area (Alternative C) tons/year							
	VOC/TNMHC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>
Powder River A MOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Powder River B MOA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gateway ATCAA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Black Hills ATCAA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Powder River 1 MOA/ATCCA	0.24	0.79	0.08	0.00	4.39	4.39	6.67
Powder River 2 MOA/ATCAA	0.46	1.49	0.15	0.01	8.31	8.31	12.61
Powder River 3 MOA/ATCAA	0.18	0.59	0.06	0.00	3.30	3.30	5.02
Powder River 4 MOA/ATCAA	0.15	0.50	0.05	0.00	2.78	2.78	4.21
Gap A MOA/ATCAA	0.01	0.03	0.00	0.00	0.15	0.15	0.23
Gap B MOA/ATCAA	0.01	0.04	0.00	0.00	0.21	0.21	0.32
Gap C MOA/ATCAA	0.00	0.01	0.00	0.00	0.07	0.07	0.10
Gateway ATCAA	0.14	0.46	0.05	0.00	2.56	2.56	3.88
<b>Total (lbs/yr)</b>	<b>1.20</b>	<b>3.90</b>	<b>0.39</b>	<b>0.02</b>	<b>21.76</b>	<b>21.76</b>	<b>33.03</b>

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**Table 9 - State Airspace Allocations  
BASELINE**

Powder River A MOA/ATCCA	3,047
Montana	87%
N. Dakota	0%
S. Dakota	13%
Wyoming	0%
<b>Total</b>	<b>1.00</b>

Powder River B MOA/ATCAA	1,385
Montana	36%
N. Dakota	0%
S. Dakota	5%
Wyoming	59%
<b>Total</b>	<b>1.00</b>

<b>PROPOSED</b>	
Powder River 1 MOA/ATCCA	5,974
Montana	89%
N. Dakota	0%
S. Dakota	0%
Wyoming	11%
Powder River 2 MOA/ATCAA	8,163
Montana	63%
N. Dakota	0%
S. Dakota	19%
Wyoming	18%
Powder River 3 MOA/ATCAA	4,547
Montana	37%
N. Dakota	50%
S. Dakota	13%
Wyoming	0%
Powder River 4 MOA/ATCAA	5,281
Montana	0%
N. Dakota	55%
S. Dakota	45%
Wyoming	0%
Gap A MOA/ATCAA	949
Montana	83%
N. Dakota	0%
S. Dakota	0%
Wyoming	17%
Gap B MOA/ATCAA	1,694
Montana	52%
N. Dakota	0%
S. Dakota	48%
Wyoming	0%
Gap C MOA/ATCAA	670
Montana	0%
N. Dakota	49%
S. Dakota	51%
Wyoming	0%

**Table 10 Airspace Square Mile Allocations by State - Modified Alternative A**

	PR 1A	PR 1B	PR 1C	PR 1D	Total PR 1	PR 2	PR 3	PR 4	Gap A	Gap B	Gap C
MT	765	1,222	680	2,673	5,340	5,147	1,696	-	783	875	-
ND	-	-	-	-	-	-	2,264	2,907	-	-	331
SD	-	-	-	-	-	1,561	587	2,374	-	819	339
WY	-	-	-	634	634	1,455	-	-	166	-	-
<b>Total</b>	<b>765</b>	<b>1,222</b>	<b>680</b>	<b>3,307</b>	<b>5,974</b>	<b>8,163</b>	<b>4,547</b>	<b>5,281</b>	<b>949</b>	<b>1,694</b>	<b>670</b>

**Table 11 Baseline Emissions (tons/year)**

	VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Montana	0.24	1.72	26.58	2.18	3.45	3.45	5,875	0.17	0.19	5,938
North Dakota	-	-	-	-	-	-	-	-	-	-
South Dakota	0.03	0.25	3.80	0.31	0.49	0.49	840	0.02	0.03	849
Wyoming	0.11	0.81	12.59	1.04	1.65	1.65	2,808	0.08	0.09	2,838
<b>Total (tpy)</b>	<b>0.38</b>	<b>2.78</b>	<b>42.96</b>	<b>3.54</b>	<b>5.59</b>	<b>5.59</b>	<b>9,523</b>	<b>0.27</b>	<b>0.31</b>	<b>9,624</b>

**Table 12 Annual Emissions from the Proposed Training Modified Alternative A (tons/year)**

	VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Montana	0.66	3.40	50.19	4.11	7.28	7.28	10,638	0.30	0.33	10,729
Net Change from Existing Conditions	0.42	1.68	23.62	1.93	3.83	3.83	4,763	0.13	0.14	4,791
North Dakota	0.11	0.61	9.19	0.75	1.26	1.26	1,991	0.06	0.06	2,006
Net Change from Existing Conditions	0.11	0.61	9.19	0.75	1.26	1.26	1,991	0.06	0.06	2,006
South Dakota	0.15	0.72	10.57	0.87	1.57	1.57	2,223	0.06	0.07	2,239
Net Change from Existing Conditions	0.11	0.48	6.77	0.55	1.08	1.08	1,383	0.04	0.04	1,390
Wyoming	0.13	0.64	9.27	0.76	1.39	1.39	1,939	0.05	0.06	1,955
Net Change from Existing Conditions	0.02	(0.18)	(3.32)	(0.28)	(0.26)	(0.26)	(869)	(0.02)	(0.03)	(882)
<b>Total Alternative A</b>	<b>1.04</b>	<b>5.37</b>	<b>79.23</b>	<b>6.49</b>	<b>11.50</b>	<b>11.50</b>	<b>16,791</b>	<b>0.47</b>	<b>0.52</b>	<b>16,930</b>
<b>Total Net Change - Alt A minus</b>	<b>0.66</b>	<b>2.59</b>	<b>36.26</b>	<b>2.95</b>	<b>5.90</b>	<b>5.90</b>	<b>7,268</b>	<b>0.20</b>	<b>0.21</b>	<b>7,305</b>
NEPA Significance Thresholds	100	100	100	100	100	100	NA	NA	NA	NA

**Table 13 Annual Emissions from the Proposed Training Alternative B (tons/year)**

	VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Montana	0.82	3.06	41.22	3.43	7.35	7.35	7,961.99	0.22	0.26	8,046.56
Net Change from Existing Conditions	0.58	1.34	14.64	1.25	3.90	3.90	2,086.51	0.06	0.07	2,108.59
North Dakota	0.51	2.02	27.66	2.29	4.74	4.74	5,450.92	0.15	0.18	5,508.82
Net Change from Existing Conditions	0.51	2.02	27.66	2.29	4.74	4.74	5,450.92	0.15	0.18	5,508.82
South Dakota	0.57	2.04	27.23	2.27	4.96	4.96	5,205.02	0.15	0.17	5,260.31
Net Change from Existing Conditions	0.53	1.80	23.43	1.95	4.46	4.46	4,365.07	0.12	0.14	4,411.42
Wyoming	0.20	0.71	9.29	0.78	1.74	1.74	1,746.35	0.05	0.06	1,764.90
Net Change from Existing Conditions	0.09	(0.11)	(3.30)	(0.26)	0.09	0.09	(1,061.39)	(0.03)	(0.03)	(1,072.70)
NEPA Significance Thresholds	100	100	100	100	100	100	N/A	N/A	N/A	N/A
<b>Total (tpy)</b>	<b>1.72</b>	<b>5.04</b>	<b>62.44</b>	<b>5.23</b>	<b>13.20</b>	<b>13.20</b>	<b>10,841.11</b>	<b>0.31</b>	<b>0.35</b>	<b>10,956.14</b>

**Table 14 Annual Emissions from the Proposed Training Alternative C (tons/year)**

	VOC	CO	NO <sub>x</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> e
Montana	1.46	5.41	72.67	6.05	13.05	13.05	13,985.93	0.39	0.45	14,134.49
Net Change from Existing Conditions	1.23	3.69	46.09	3.86	9.60	9.60	8,110.45	0.23	0.26	8,196.52
North Dakota	0.13	0.71	10.46	0.86	1.51	1.51	2,218.55	0.06	0.07	2,242.12
Net Change from Existing Conditions	0.13	0.71	10.46	0.86	1.51	1.51	2,218.55	0.06	0.07	2,242.12
South Dakota	0.26	1.03	14.01	1.16	2.43	2.43	2,745.32	0.08	0.09	2,774.48
Net Change from Existing Conditions	0.23	0.78	10.21	0.85	1.93	1.93	1,905.36	0.05	0.06	1,925.59
Wyoming	0.28	1.02	13.55	1.13	2.49	2.49	2,577.65	0.07	0.08	2,605.03
Net Change from Existing Conditions	0.17	0.20	0.96	0.09	0.84	0.84	(230.08)	(0.01)	(0.01)	(232.56)
NEPA Significance Thresholds	100	100	100	100	100	100	N/A	N/A	N/A	N/A
<b>Total (tpy)</b>	<b>1.76</b>	<b>5.38</b>	<b>67.72</b>	<b>5.66</b>	<b>13.88</b>	<b>13.88</b>	<b>12,004.27</b>	<b>0.34</b>	<b>0.39</b>	<b>12,131.67</b>

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*November 2014*

***APPENDIX L***  
***SPECIAL STATUS PLANT AND ANIMAL***  
***SPECIES AND SCIENTIFIC NAMES***

*Final*  
*November 2014*

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# APPENDIX L SPECIAL STATUS PLANT AND ANIMAL SPECIES AND SCIENTIFIC NAMES

## State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 1 of 9)

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Birds							
American bittern	<i>Botaurus lentiginosus</i>	All Counties		Carter	Crook	MT S3 <sup>1</sup>	Seasonal or semi-permanent wetlands
American dipper	<i>Cinclus mexicanus</i>		Lawrence, Meade		Sheridan		Fast, clear, cold mountain streams
American white pelican	<i>Pelicanus erythrorhynchos</i>					MT S3 <sup>1</sup>	Lakes, marshes, Rivers, reservoirs
Baird's sparrow	<i>Ammodramus bairdii</i>	Bowman			Campbell	MT S3 <sup>1</sup> , S <sup>2</sup>	Native mixed-grass prairie
Bald eagle	<i>Haliaeetus leucocephalus</i>	All Counties (migrant)	Lawrence, Meade, Ziebach	All Counties (migrant)	Sheridan, Campbell	ND E <sup>1</sup> , SD T <sup>1</sup>	Riparian and lacustrine
Black-backed woodpecker	<i>Picoides arcticus</i>			Powder River	Crook, Westin	MT S3 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Early successional burned forest of mixed conifer
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	All Counties		Big Horn, Fallon	Crook, Campbell, Sheridan	MT S3 <sup>1</sup>	Woodlands, thickets, prairie shrubs, wooded urban areas
Black tern	<i>Chlidonias niger</i>			Carter		MT S3 <sup>1</sup> , S <sup>2</sup>	Wetlands, marshes, small ponds
Burrowing owl	<i>Speotyto cunicularia</i>			All Counties	All Counties	MT S3 <sup>1</sup> , ND SOC <sup>1</sup> , S <sup>2</sup> S <sup>3</sup>	Open grasslands, associated with animal burrows
Common loon	<i>Gavia immer</i>				Crook, Sheridan	MT S3 <sup>1</sup>	Clear, secluded mid-elevational lakes >4 acres

**State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 2 of 9)**

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Ferruginous hawk	<i>Buteo regalis</i>	All Counties		Carter, Custer, Fallon, Powder River, Rosebud	All Counties	ND SOC <sup>1</sup> , MT S3 <sup>1</sup> , S <sup>2</sup>	Native grasslands and shrublands
Grasshopper sparrow	<i>Ammodramus savannarum</i>		All Counties		All Counties	WY S3 <sup>1</sup> , SD S4 <sup>1</sup>	Lightly-grazed mixed-grass prairie, meadows, hayfields
Horned grebe	<i>Podiceps auritus</i>			Passage migrant		MT S3 <sup>1</sup>	large sized bodies of water, including rivers and small lakes
Lark bunting	<i>Calamospiza melanocorys</i>	All Counties				MT S4 <sup>1</sup>	Sagebrush/sage prairie, secondary mixed-grass with dispersed shrubs
Long-billed curlew	<i>Numenius americanus</i>	Golden Valley, Bowman, Sioux, Slope		All Counties	Campbell, Crook, Sheridan, Westin	MT S3 <sup>1</sup> , S <sup>2</sup>	Short-grass prairie or grazed mixed-grass
Marbled godwit	<i>Limosa fedoa</i>	All Counties (migrant)				ND SOC <sup>1</sup>	Wetlands, streams, lakes, native prairie often heavily grazed
Mountain plover	<i>Charadrius montanus</i>			Big Horn, Treasure	Campbell, Crook, Westin	MT S3 <sup>1</sup> , S <sup>2</sup>	Prairie dog colonies, shortgrass prairies
Northern goshawk	<i>Accipiter gentilis</i>	All Counties (winter range)	Black Hills area	Carter, Powder River, Rosebud	Crook, Sheridan	ND SOC <sup>1</sup> , MT S3 <sup>1</sup> , S <sup>2</sup>	Coniferous and aspen forests in mid-altitudes
Osprey	<i>Pandion haliaetus</i>		Lawrence		All Counties	SD T <sup>1</sup>	Near large rivers and lakes
Swainson's hawk	<i>Buteo swainsoni</i>	All Counties				ND SOC <sup>1</sup> , SD SOC <sup>1</sup>	prairies



**State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 3 of 9)**

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Upland sandpiper	<i>Bartramia longicauda</i>	Grant, Hettinger, Morton				ND SOC <sup>1</sup>	Dry, open mixed- grass prairie
Western yellow-billed cuckoo	<i>Coccyzus americanus americanus</i>		Lawrence	Big Horn, Carter, Custer, Rosebud	Rare - Crook, Sheridan	MT S3 <sup>1</sup> , S <sup>2</sup>	Cottonwood – riparian areas
Willet	<i>Tringa semipalmata</i>	All Counties				ND SOC <sup>1</sup>	Wetlands, uplands; native prairies
Wilson’s phalarope	<i>Phalaropus tricolor</i>	All Counties				ND SOC <sup>1</sup>	Shallow wetlands or mudflats
<b>Mammals</b>							
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>	Bowman		All Counties	All Counties	MT S3 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Short grass grazed rangeland
Hoary Bat	<i>Lasiurus cinereus</i>			All Counties		MT S3 <sup>1</sup>	Riparian and forest
Meadow jumping mouse	<i>Zapus hudsonius</i>				Bear Lodge sub species in Crook, Westin	SOC <sup>1</sup>	Dense, tall, lush grasses in marshy areas, riparian upland slopes within ponderosa pine
Pallid bat	<i>Antrozous pallidus</i>			Big Horn, Carbon, Rosebud		MT S3 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Ponderosa pine and big sagebrush with rock outcrops
River otter	<i>Lutra canadensis</i>		Meade		Sheridan	SD T <sup>1</sup>	Rivers
Spotted bat	<i>Euderma maculatum</i>			Big Horn, Treasure		MT S3 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Open, arid habitats close to tall cliffs
Swift fox	<i>Vulpes velox</i>	Slope	Corson, Perkins, Butte		Crook, Campbell, Westin	ND SOC <sup>1</sup> , MT S3 <sup>1</sup> , S <sup>2</sup>	Shortgrass prairies, grasslands
Townsend’s big-eared bat	<i>Corynorhinus townsendii</i>			Big Horn, Carter, Custer, Powder River, Rosebud	All Counties	ND SOC <sup>1</sup> , MT S3 <sup>1</sup> , WY S2 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Caves and abandoned mines nears conifer and bottomland woodlands

**State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 4 of 9)**

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Fish							
Blue sucker	<i>Cycleptus elongates</i>	Morton, Sioux		Custer, Powder River, Rosebud, Treasure		ND SOC <sup>1</sup> , MT S3 <sup>1</sup> , S <sup>2</sup>	Swift current turbid rivers w/ rocky or gravel bottoms
Burbot	<i>Lota lota</i>			Big Horn, Custer, Powder River, Rosebud		ND SOC <sup>1</sup>	Large rivers and cold, deep lakes and reservoirs
Longnose sucker	<i>Catostomus catostomus</i>		Butte, Meade			SD T <sup>1</sup>	Clear, cold, deep water of lakes and tributary streams
Northern redbelly dace	<i>Phoxinus eos</i>		Corson				Quiet waters from beaver ponds, bogs and clear streams
Paddlefish	<i>Polyodon spathula</i>	Morton, Sioux		Custer, Rosebud		ND SOC <sup>1</sup> , MT S2 <sup>1</sup> , S <sup>2</sup>	Large rivers
Sauger	<i>Stizostedion canadense</i>			All Counties	Campbell, Sheridan	MT S2 <sup>1</sup> , S <sup>2</sup>	Large turbid rivers and shallow turbid lakes
Sturgeon chub	<i>Macrhybopsis gelida</i>	Billings, Bowman, Golden Valley, Slope, Sioux	Harding, Zeibach	Custer, Powder River, Rosebud	Campbell, Sheridan	ND C <sup>1</sup> , MT S2S3 <sup>1</sup> , S <sup>2</sup>	Turbid rivers w/ sand or gravel bottoms
Yellowstone cutthroat trout	<i>Oncorhynchus clarki bouvieri</i>			Rosebud	Sheridan	MT S2 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Clear, cold streams, rivers and lakes
Amphibians and Reptiles							
False map turtle	<i>Graptemys pseudogeographica</i>	Sioux	Corson			ND SOC <sup>1</sup> , SD T <sup>1</sup>	Slow portion of larger rivers
Milksnake	<i>Lampropeltis triangulum</i>			Big Horn, Custer, Powder River, Rosebud		MT S2 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Open sagebrush grasslands, ponderosa pine, rocky outcrops and hillsides

**State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 5 of 9)**

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Northern leopard frog	<i>Rana pipiens</i>				All Counties	S <sup>2</sup> ,S <sup>3</sup>	Low-elevation and valley bottom ponds, lakes, creeks, springs, marshes.
Plains spadefoot	<i>Spea bombifrons</i>	All Counties		Big Horn, Carter, Custer, Powder River, Rosebud, Treasure		MT S3 <sup>1</sup> , S <sup>2</sup> ,S <sup>3</sup>	Dry grasslands
Smooth green snake	<i>Liochlorophis vernalis</i>	All Counties			Crook,Westin	SD SOC <sup>1</sup>	Grasslands
Snapping turtle	<i>Chelydra serpentina</i>			Big Horn, Carter, Custer, Fallon, Powder River, Rosebud		MT S3 <sup>1</sup> , S <sup>2</sup>	Major rivers, smaller reservoirs and streams with sandy or muddy bottoms
Spiny softshell	<i>Apalone spinifera</i>			Big Horn, Carter, Custer, Powder River, Rosebud, Treasure	Campbell, Crook, Sheridan, Westin	MT S3 <sup>1</sup> , S <sup>2</sup>	Prairie rivers and larger streams.
Western hog-nosed snake	<i>Heterodon nasicus</i>	All Counties		All Counties		MT S2 <sup>1</sup> , S <sup>2</sup> , S <sup>3</sup>	Sandy or gravelly habitats, often by rivers
Plants							
Alderleaf mountain-mahogany	<i>Cercocarpus montanus</i>			Treasure		MT S2S3 <sup>1</sup>	Open slopes and breaks on the plains

**State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 6 of 9)**

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
American trailplant	<i>Adenocaulon bicolor</i>				Crook	WY SOC <sup>1</sup>	Moist, shady birch/hazelnut woods
Blue toadflax	<i>Nuttallanthus texanus</i>			Carter		MT S1S2 <sup>1</sup> , S <sup>2</sup>	Shale soils of plains grassland and woodland
Bractless hedge-hyssop	<i>Gratiola ebracteata</i>			Yellowstone		MT S2 <sup>1</sup>	Dry mud around ponds in foothills and plains
Bractless mentzelia	<i>Mentzelia nuda</i>			Custer, Powder River, Rosebud		MT SOC <sup>1</sup>	Sandy or gravelly soil of open hills and roadsides
Bur oak	<i>Quercus macrocarpa</i>			Carter		MT S2 <sup>1</sup> , S <sup>2</sup>	Co-dominant with Rocky Mtn. juniper and ponderosa pine or with green ash.
Cottongrass bulrush	<i>Scirpus cyperinus</i>				Crook	WY SOC <sup>1</sup>	Wet low ground
Desert groundsel	<i>Senecio eremophilus</i>			Big Horn		MT S1S2 <sup>1</sup>	Streambanks and riparian forests
Dwarf scouring rush	<i>Equisetum scirpoides</i>				Crook	SD M <sup>1</sup>	Shaded, damp, moss-covered rocks along streams in white spruce and fir woods.
Foxtail sedge	<i>Carex alopecoidea</i>				Crook	SD M <sup>1</sup>	Wet meadows and willow-sedge communities
Large flowered beardtongue	<i>Penstemon grandiflorus</i>			Custer		MT S1 <sup>1</sup>	Sandy soil of valley on the plains
Letterman's needlegrass	<i>Stipa lettermanii</i>			Big Horn		MT S1S3 <sup>1</sup>	Limestone talus and dry fescue grasslands
Marsh muhly	<i>Muhlenbergia glomerata</i>				Crook	SD M <sup>1</sup>	Limestone talus and dry fescue grasslands

**State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 7 of 9)**

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Nannyberry	<i>Viburnum lentago</i>			Big Horn		MT S2S3 <sup>1</sup> , S <sup>2</sup>	Openings in riparian forests in the plains.
Narrowleaf milkweed	<i>Asclepias stenophylla</i>			Carter, Rosebud		MT S <sup>2</sup> , S <sup>2</sup>	Openings in riparian forests in the plains
Narrowleaf penstemon	<i>Penstemon angustifolius</i>			Carter, Fallon		MT S2S3 <sup>1</sup> , S <sup>2</sup>	Sandy prairie grasslands
Nine-anther prairie clover	<i>Dalea enneandra</i>			Big Horn, Custer, Fallon		MT S2S3 <sup>1</sup>	Gravelly-soiled grasslands on the plains
Nuttall desert-parsley	<i>Lomatium nuttallii</i>			Big Horn, Rosebud		SD M <sup>1</sup> , MT S <sup>2</sup> , S <sup>2</sup>	Open, rocky pine woodlands in mid to lower elevation.
Ovalleaf milkweed	<i>Asclepias ovalifolia</i>			Carter		MT S1S2 <sup>1</sup> , S <sup>3</sup>	Open pine woodlands, prairies and dry riparian terraces
Persistent-sepal yellow- cress	<i>Rorippa calycina</i>			Big Horn, Custer, Rosebud, Treasure, Yellowstone		MT SH <sup>1</sup> , S <sup>2</sup>	Moist sandy to muddy banks of streams, ponds, reservoirs near high water line.
Prairie aster	<i>Aster ptarmicoides</i>			Carter			Open, dry grasslands on sandy or limestone plains
Prairie moonwort	<i>Botrychium campestre</i>				Crook	SD M <sup>1</sup> , MT S1S2 <sup>1</sup>	Prairies, dunes, and fields over limestone
Pregnant sedge	<i>Carex gravida</i>			Big Horn, Carter, Powder River, Rosebud			Green ash ravines and wooded draws
Sand cherry	<i>Prunus pumila</i>			Fallon		MT S1S3 <sup>1</sup>	Sandy or rocky soils in grasslands on the plains.

**State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 8 of 9)**

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Scribner's panic grass	<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>			Powder River		MT S1S2 <sup>1</sup> , S <sup>2</sup>	Sandy pinelands and wooded draws will well-drained soils.
Slender wedgegrass	<i>Sphenopholis intermedia</i>			Carter			Wet areas in valleys or foothills
Slender-branched popcorn-flower	<i>Plagiobothrys leptocladus</i>			Custer		MT S2S3 <sup>1</sup> , S <sup>2</sup>	Drying mud on shores of ponds in plains and foothills.
Smooth goosefoot	<i>Chenopodium subglabrum</i>			Custer		SD M <sup>1</sup>	Loose, sandy soils in early successional sparsely vegetated habitats.
Spotted Joepye-weed	<i>Eupatorium maculatum</i>			Big Horn		MT S1S2 <sup>1</sup>	Moist meadows, springs, swamp thickets
Sweetwater milkvetch	<i>Astragalus aretioides</i>			Big Horn		MT S2S3 <sup>1</sup> , S <sup>2</sup>	Exposed ridges & slopes often in opening of Douglas fir
Trailing clubmoss	<i>Lycopodium complanatum</i>				Crook	SD M <sup>1</sup>	Semi-shady white spruce/paper birch forest
Treelike clubmoss	<i>Lycopodium dendroideum</i>				Crook	SD M <sup>1</sup> , MT S2 <sup>1</sup> , S <sup>3</sup>	Moist coniferous forests
Visher's buckwheat	<i>Eriogonum visherii</i>			Carter, Powder River		SD M <sup>1</sup> , MT S2 <sup>1</sup> , S <sup>2</sup>	Barren rock outcrops or clay outwash
White-bract stickleaf	<i>Mentzelia montana</i>			Custer			Grasslands and sparsely vegetated slopes in the plains.
Woolly twinpod	<i>Physaria didymocarpa</i> var. <i>lanata</i>			Big Horn, Rosebud		MT S2S3 <sup>1</sup> , S <sup>2</sup>	Sandy open grasslands or shrubland slopes in plains

### State Listed \*Special Status Species with Potential to Occur Under the Proposed Airspace and Their Counties of Occurrence (Page 9 of 9)

Common Name	Scientific Name	Project Area States and Counties				Protection Status	Habitat
		ND	SD	MT	WY		
Wyoming thistle	<i>Cirsium pulcherrimum</i>			Powder River		MT S3 <sup>1</sup>	Sparsely-vegetated soils of washes and gullies.
Yellow bee plant	<i>Cleome lutea</i>			Big Horn		MT S1S2 <sup>1</sup> , S <sup>2</sup>	Open sandy sagebrush steppe

(<sup>1</sup> = State Status/Ranking; <sup>2</sup> = BLM; <sup>3</sup> = USFS)

**Sources:** MTFWP 2005; MTNHP 2007; MTNHP 2014; Hagen et al. 2005; Nature Serve 2007; SDGFP 2008; SDGFP 2002; SDGFP 2014; SDB 2008; WYGF 2005; Fertig et al. 1994; WYNDD 2003; WYNDD 2014)

**\*Note:** Special Status Species are species that have some legal or policy protections in place (whether by state resource agencies or federal entities such as the BLM or USFS), but are not listed or proposed for protection under the Endangered Species Act.

C=candidate; D=delisted; E=endangered; PE = Proposed Endangered; HS=highly safeguarded; LE= listed endangered; LT= listed threatened; T=threatened; PT=proposed threatened; S=sensitive; SOC=species of concern; SR=salvage restricted; WSC=wildlife of special concern; XN= Experimental Nonessential population; M = Monitored

Values and their definitions:

State rank characterizes the relative rarity or endangerment within the state of Washington. Factors including, but not limited to, number of known occurrences are considered when assigning a rank. Two codes together represent an inexact range (e.g., S1S2) or different ranks for breeding and non-breeding populations (e.g., S1B, S3N).

S1 = Critically imperiled in the state because of extreme rarity or other factors making it especially vulnerable to extirpation from the state. (Typically 5 or fewer occurrences or very few remaining individuals or acres)

S2 = Imperiled in the state because of rarity or other factors making it very vulnerable to extirpation from the state. (Typically 6 to 20 occurrences or few remaining individuals or acres)

S3 = Rare or uncommon in the state. (Typically 21 to 100 occurrences)

S4 = Widespread, abundant, and apparently secure in state, with many occurrences, but the taxon is of long-term concern. (Usually more than 100 occurrences)

S5 = Demonstrably widespread, abundant, and secure in the state; believed to be ineradicable under present conditions.

SH = Historical occurrences only are known, perhaps not verified in the past 20 years, but the taxon is suspected to still exist in the state.

SP = Potential for occurrence of the taxon in the state but no occurrences have been reported.

SR = Reported in the state but without persuasive documentation which would provide a basis for either accepting or rejecting the report (e.g., misidentified specimen).

SRF = Reported falsely in the state but the error persists in the literature.

SU = Uncertain. Possibly in peril in the state, but status is uncertain. More information is need.

SX = Believed to be extirpated from the state with little likelihood that it will be rediscovered.

S? = Not yet ranked. Sufficient time and effort have not yet been devoted to ranking of this taxon.

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*November 2014*

***APPENDIX M***  
***LETTERS OF AGREEMENT***

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*November 2014*

**Denver Air Route Traffic Control Center/Salt Lake City Air Route Traffic Control Center/  
28th Bomb Wing, Ellsworth AFB**

**LETTER OF AGREEMENT**

Effective: December 10, 2006

**SUBJECT: POWDER RIVER TRAINING COMPLEX AND CROSSBOW ATCAA**

**1. PURPOSE:** This Letter of Agreement defines areas, responsibilities, and procedures for the Powder River "A" and "B" Military Operations Areas (MOA), the Powder River Air Traffic Control Assigned Airspace (ATCAA), the Gateway ATCAA, the Black Hills ATCAA, and the Crossbow ATCAA, among Denver Air Route Traffic Control Center (Center), Salt Lake City Air Route Traffic Control Center (Center), and the 28th Bomb Wing, Ellsworth Air Force Base, South Dakota.

**2. BACKGROUND:** The 28th Bomb Wing (28 BW) has the operational requirement to perform high and low altitude training with, and without, support from the Belle Fourche Electronic Scoring Site located within the Powder River Training (PRT) Complex. Composite and multi-force exercises are also performed in the PRT Complex. The Crossbow ATCAA airspace redesign was developed to allow training aircraft to use only a small block of airspace needed for the exercise. It is not intended for use of large altitude blocks.

**3. CANCELLATION:** This agreement cancels the Letter of Agreement (LOA) among Denver Center, Salt Lake City Center, and the 28th Bomb Wing, Powder River Training Complex and Crossbow ATCAA, dated June 12, 2005.

**4. SCOPE:**

a. The provisions of this agreement are applicable to Denver Center, Salt Lake City Center, and the 28 BW and are supplemental to FAA Order 7610.4, Special Military Operations, and FAA Order 7110.65, Air Traffic Control, and appropriate military regulations. The provisions of this agreement may be canceled or amended by any one signatory notifying the others through written coordination.

b. The MOAs and ATCAAs are depicted in Attachments 1 through 4. The altitudes designated are described as follows:

- (1) Powder River "A" MOA – Surface up to, but not including, FL180.
- (2) Powder River "B" MOA – 1,000 feet AGL up to, but not including, FL180.
- (3) Powder River ATCAA – FL180 to FL260 inclusive, or as assigned.
- (4) Gateway ATCAA – FL180 to FL260 inclusive, or as assigned.
- (5) Black Hills ATCAA – FL200 to FL230 inclusive.
- (6) Crossbow ATCAA – FL270 to FL450 inclusive, or as assigned. (See paragraph 6b(7) for non-usable times and intended use of airspace.)

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- c. The Powder River "A" MOA, Powder River "B" MOA, Powder River ATCAA, Gateway ATCAA, and Black Hills ATCAA are all parts of the PRT Complex. Reference to the PRT Complex may include any one area or combinations of areas. The Crossbow ATCAA is not part of the PRT Complex.

**5. RESPONSIBILITIES:**

- a. The 28 BW shall:
- (1) Be the scheduling agency.
  - (2) Be responsible for the overall airspace management of the airspace within the complex.
  - (3) Ensure that all participating aircrews are familiar with and adhere to the provisions of this agreement.
- b. Salt Lake City Center is the controlling agency for the Powder River "A" MOA.
- c. Denver Center is the controlling agency for:
- (1) Powder River "B" MOA.
  - (2) Powder River ATCAA.
  - (3) Gateway ATCAA.
  - (4) Black Hills ATCAA.
  - (5) Crossbow ATCAA.

**6. PROCEDURES:** Unless otherwise coordinated:

- a. Time Conversion. The symbol ‡ indicates that during periods of Daylight Savings Time, effective hours will be 1 hour earlier than shown.
- b. Airspace Coordination.
- (1) The 28 BW shall ensure that the Denver Center Military Coordinator (MC) and the Salt Lake City Center MC receive the daily schedule for the planned activity in the PRT Complex and/or the Crossbow ATCAA by 2200Z‡ (1500 local), the day prior, for the next 24-hour period that starts at 0700Z‡ (0000 local). All changes and/or modifications to the schedule shall be coordinated at least 2 hours in advance.
  - (2) Only the airspace, time period, and altitude blocks needed to accomplish the desired maneuvers shall be requested.

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(3) When cleared to operate in the Crossbow ATCAA at and above FL270, aircrews shall maintain a listening watch on Denver Center frequency 133.67/322.5. Should it become necessary for Denver Center or Salt Lake City Center to recall the airspace at and above FL270, it is expected that the aircrews will be able to return the airspace within a maximum of 30 minutes.

NOTE: Salt Lake City Center should coordinate with Denver Center MC position for recall of airspace at and above FL270.

(4) The 28 BW airspace manager shall provide Denver Center and Salt Lake City Center a current telephone list of personnel to contact in the event either Center must recall or restrict the use of scheduled airspace. If either Center recalls or restricts the use of scheduled airspace, they shall inform the other Center as soon as practicable.

(5) The Powder River "A" and "B" MOAs shall be scheduled simultaneously, not separately.

(6) "Time of Use" for the Powder River "A" and "B" MOAs are "Intermittent by NOTAM."

(7) The Crossbow ATCAA is not usable at and above FL270 between 1500-1800Z† (0800-1100 local) and 2130-2330Z‡ (1430-1630 local) daily. The airspace will be given in block altitudes of 1000 feet per aircraft (i.e., A flight of two aircraft will generally be approved for a 2000 foot block). When a climb from lower altitude is required within the lateral confines of the ATCAA, an expanded block may be temporarily granted by the controller until the formation is established within the requested block.

(8) Scheduling of the Powder River MOAs are predicated on the procedures in paragraph 6b(1) and (4); however, the areas are not released to the user until the pilot(s) have received a clearance into the area by Denver Center or Salt Lake City Center.

NOTE: If an aircraft is scheduled to enter the Powder River MOAs via a Military Training Route (MTR), the pilot shall request clearance into the MTR and the Powder River MOA simultaneously. Entry into the Powder River MOA is not automatic with the MTR clearance.

(9) The Black Hills ATCAA will only be used for marshalling or aerial refueling for multi-force exercises, in conjunction with the remaining PRT Complex airspace, with at least 3 administrative working days notification to Denver Center.

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(10) For aircraft other than on an MTR, each FAA facility is responsible for notifying the other facility whenever participating aircraft have requested entry into the PRT Complex or Crossbow ATCAA. This can be accomplished through the facilities' operations supervisors or from controller to controller.

(11) Denver Center:

For aircraft entering PRT Complex area(s) from RAP308069 (ARCOT) or from RAP326036:

(a) Sector 31 shall coordinate activation, changes of assigned altitude blocks, and deactivation of the PRT Complex area(s) with Salt Lake City Center Sector 17 and the adjacent Minneapolis Center Sector(s), and when appropriate, Sectors 22 and 32.

(b) Sector 32 shall coordinate activation, changes of assigned altitude blocks, and deactivation of the Crossbow ATCAA with Salt Lake City Center Sector 17 and the adjacent Minneapolis Center Sector(s).

(12) Salt Lake City Center:

For aircraft entering PRT Complex area(s) from MLS146037:

(a) Sector 17 shall coordinate activation, changes of assigned altitude blocks, and deactivation of the PRT Complex area(s) with Denver Center Sectors 22 and 31 and the adjacent Minneapolis Center Sector(s), and when appropriate, Denver Center Sector 32.

(b) Sector 17 shall coordinate with Denver Center Sectors 22 and 31 prior to approving altitude changes within the PRT Complex, and with Denver Center Sector 32 prior to approving altitude changes within the Crossbow ATCAA, and shall advise the adjacent Minneapolis Center sector(s) of any altitude changes.

(13) When Denver Center and or Salt Lake City Center grant approval for operations in the Powder River MOAs, air traffic control (ATC) responsibility does not include Class G airspace. The Aeronautical Information Manual, Chapter 3, Section 4, defines ATC and VFR/IFR pilot responsibilities within MOAs.

c. Flight Planning and En Route Procedures.

(1) Flights shall enter the MOAs at 16,000 feet MSL using the standard entry point (ARCOT) when utilizing only the MOAs or when entering below FL180. When entering at or above FL180, flights shall enter within the scheduled ATCAA altitude block.

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(2) Two navigation fixes, MLS119074 (LIBON) and RAP301089 (PLAAT), are required as a minimum when flight planning into the PRT Complex and/or the Crossbow ATCAA so that Denver Center and Salt Lake City Center receive proper flight plan information. Two unnamed fix/radial distances and four named fixes have been associated with Fix/Radial/Distance to simplify internal flight planning (see Attachment 2, Powder River ATCAA and Attachment 3, Crossbow ATCAA). They are identified as:

- (a) ARCOT      RAP308069      (44° 51.9' - 104° 01.8') – standard entry fix
- (b) LIBON      MLS119074      (45° 31.1' - 104° 41.5') – navigation fix
- (c) PLAAT      RAP301089      (44° 59.8' - 104° 31.0') – navigation fix
- (d) DRAGG      RAP295077      (44° 45.5' - 104° 25.9') – standard exit fix
- (e)              RAP326036      (44° 32.0' - 103° 19.0') – southeast entry/exit fix
- (f)              MLS146037      (45° 48.0' - 105° 40.0') – northwest entry/exit fix

(3) The aircraft shall file using the following format at a minimum (entry to exit): ..ARCOT..LIBON..PLAAT/D(hr)+(min)..DRAGG.. Other entry and exit fixes may be used prior to and after this required format.

Example:

..MLS146037..ARCOT..LIBON..PLAAT/D(hr)+(min)..DRAGG..RAP326036..

(4) Flight plan “Remarks” should include the airspace, entry and exit times, and MARSA, if appropriate.

(5) It shall be the responsibility of each pilot cleared to operate in the addressed airspace to remain within the confines of the airspace and to remain on the assigned Denver Center or Salt Lake City Center frequency unless approved to change frequency for a specified period of time. Radio communications are severely reduced below 16,000 feet MSL in the Powder River area.

NOTE: See Attachment 5 for communications frequencies of interest for the PRT Complex and the Crossbow ATCAA.

(6) Military Authority Assumes Responsibility for Separation of Aircraft (MARSA) shall apply between participating aircraft while operating in the PRT Complex and the Crossbow ATCAA and aircraft operating on MTRs that traverse the MOAs.

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(7) Pilots shall use the current Rapid City, South Dakota, altimeter setting while operating below FL180 and an altimeter setting of 29.92 while operating at and above FL180 within the MOAs/ATCAAs. The altimeter setting shall be issued to participating aircraft as part of the clearance into the Powder River MOAs.

(8) All aircraft proposing to use the defined airspace shall have an operating transponder. The lead aircraft of formation flights shall remain on the assigned discrete beacon code. While operating within the PRT Complex and the Crossbow ATCAA, wingmen not previously assigned a discrete beacon code shall squawk code 4000 after formation breakup. After the aircraft have joined up in formation, and prior to exiting the airspace, wingmen shall squawk standby.

(9) Unless otherwise coordinated, pilots shall operate into and out of the PRT Complex on an IFR flight plan. Aircraft requesting to depart the airspace VFR are responsible for notifying either Denver Center or Salt Lake City Center, as appropriate.

(10) Stereo flight routes are available for local sorties from Ellsworth AFB.

(a) PRT1: RCA..RAP110060..ARCOT..LIBON..PLAAT/D1+00..DRAGG..RCA

(b) PRT2:  
RCA..RAP110060..ARCOT..LIBON..PLAAT/D1+00..DRAGG..RAP179037..  
BFF018067..BFF327070..CDR291055.IR499.JAC186035..PIH069090..DDY..  
RCA

(c) PRT3:  
RCA..RAP152027..RAP336053..RAP285081..RAP273070..RAP212070/D0+45  
.AR678.RAP199082..RAP345042..ARCOT..LIBON..PLAAT/D1+00..DRAGG..  
RCA

(d) PRT4:  
RCA..RAP110060..ARCOT..LIBON..PLAAT/D1+00..DRAGG..SHR098087..  
RAP285081..RAP273070..RAP212070/D0+45.AR678.RAP199082..RCA

(e) PRT5:  
RCA..RAP213061..BFF018067..BFF327070..CDR291055.IR499.JAC186035..  
PIH069090..DDY..RAP297035..ARCOT..LIBON..PLAAT/D1+00..DRAGG..RCA

d. Exit Procedures.

(1) Aircraft on an MTR shall exit the Powder River area at the expiration of the filed delay time and at an altitude within the published vertical limits of the MTR.



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(2) Aircrews should inform ATC of their exit time at least 10 minutes prior to exiting the airspace. All aircraft shall remain within the PRT Complex or the Crossbow ATCAA until an IFR clearance to exit the airspace has been issued by either Denver Center or Salt Lake City Center.

(3) Use of the standard exit point (DRAGG) at 17,000 MSL is expected for aircraft returning directly to Ellsworth AFB; however, the other entry/exit fixes may be used in Class A for flights with follow-on activities or desiring a high approach into Ellsworth.

(4) Pilots shall, when requesting to exit the Powder River MOAs/ATCAA, contact Denver Center on 127.95 or 338.2 MHz, at or below FL260. When exiting the Crossbow ATCAA at and above FL270, pilots shall contact Denver Center on 133.67 or 322.4 MHz. Pilots shall, when exiting the Powder River MOAs/ATCAA at the MLS146037 fix (northwest exit fix), contact Salt Lake City Center on 126.85 or 305.2 MHz.

(5) If there is no contact with Denver Center on frequency 127.95 or 338.2 MHz, attempt contact with Denver Center on 135.6 or 363.02 MHz or Salt Lake City Center on 364.8 MHz (Tactical).

(6) The PRT Complex and Crossbow ATCAA area airspaces are automatically released back to the controlling agencies when the last aircraft has exited the airspace.

**7. LOST COMMUNICATIONS:**

a. If radio failure occurs before a delay clearance in the PRT Complex or the Crossbow ATCAA is received, follow the procedures specified in CFR part 91.185 and the DOD Flight Information Handbook.

b. If radio failure occurs after the delay clearance has been issued, aircraft shall exit the airspace at the expiration of the delay time.

c. If recovering VFR to Ellsworth AFB, the aircraft shall climb or descend to 15,500 feet MSL prior to departing the area and proceed directly to the Initial Approach Fix for the runway of departure or active runway, if known, and execute the approach in accordance with the procedures specified in the DOD Flight Information Handbook.

d. If recovering IFR to Ellsworth AFB, the aircraft shall climb or descend to 17,000 feet MSL or the lowest altitude of the assigned block, whichever is highest, prior to departing the area and proceed directly to the Initial Approach Fix for the runway of departure or active runway, if known, and execute the approach in accordance with procedures specified in the DOD Flight Information Handbook.

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- e. If not recovering to Ellsworth AFB, follow the procedures specified in CFR part 91.185 and the DOD Flight Information Handbook.

**8. ATTACHMENTS:**

- a. Attachment 1. Powder River “A” MOA and Powder River “B” MOA.
- b. Attachment 2. Powder River ATCAA and Gateway ATCAA.
- c. Attachment 3. Crossbow ATCAA.
- d. Attachment 4. Black Hills ATCAA and PRT Complex.
- e. Attachment 5. Communications Frequencies.

**9. APPROVED:**

James L. Powell  
Air Traffic Manager, Denver Center  
Federal Aviation Administration

Sherry A. Butler  
Air Traffic Manager, Salt Lake City Center  
Federal Aviation Administration

Jeffry F. Smith, Colonel, USAF  
Commander, 28th Bomb Wing  
Ellsworth AFB, South Dakota

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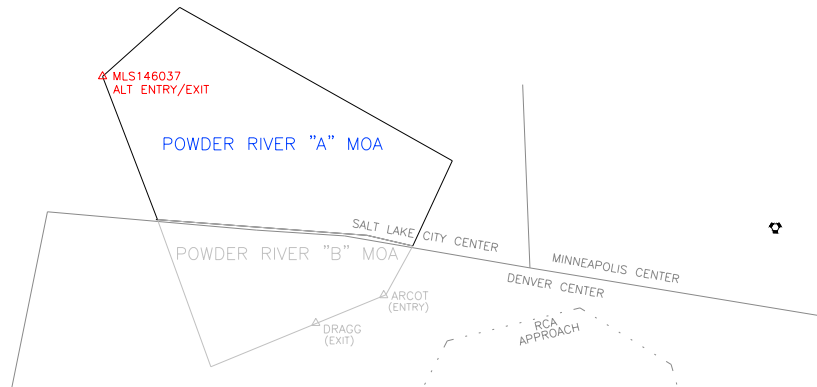
**Denver Air Route Traffic Control Center/Salt Lake City Air Route Traffic Control Center/28th BW, Ellsworth AFB – Letter of Agreement**

**Attachment 1**

The **POWDER RIVER "A" MOA** is designated from the surface up to, but not including, FL180. The boundaries are:

Beginning at

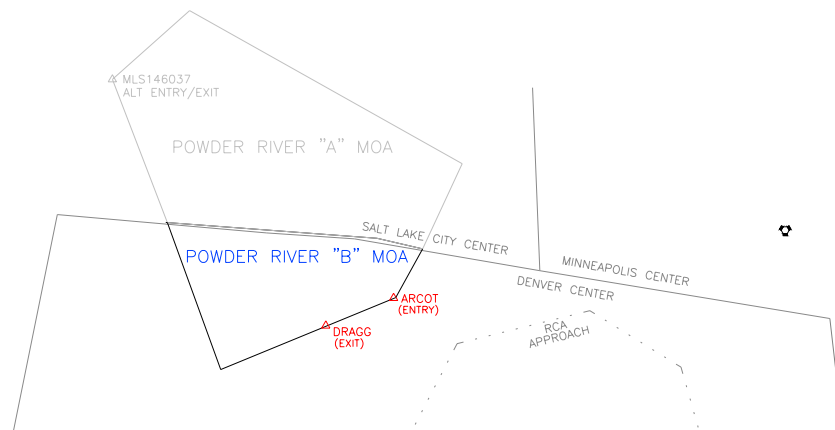
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The **POWDER RIVER "B" MOA** is designated from 1,000 feet AGL up to, but not including, FL180. The boundaries are:

Beginning at

45°04'00"N - 103°51'02"W (RAP 318075) to 44°52'00"N - 104°01'02"W (RAP 308069) to 44°35'00"N - 105°03'02"W (GCC 044025) to 45°12'00"N - 105°21'02"W (GCC 357052) to 45°07'00"N - 104°07'02"W (GCC 041076) to the point of beginning.



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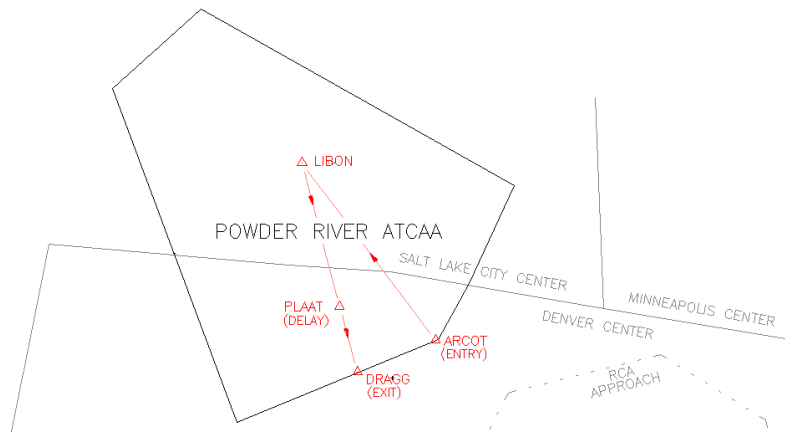
**Denver Air Route Traffic Control Center/Salt Lake City Air Route Traffic Control Center/28th BW, Ellsworth AFB – Letter of Agreement**

**Attachment 2**

The POWDER RIVER ATCAA is designated from FL180 through FL260 inclusive, or as assigned. The boundaries are:

Beginning at

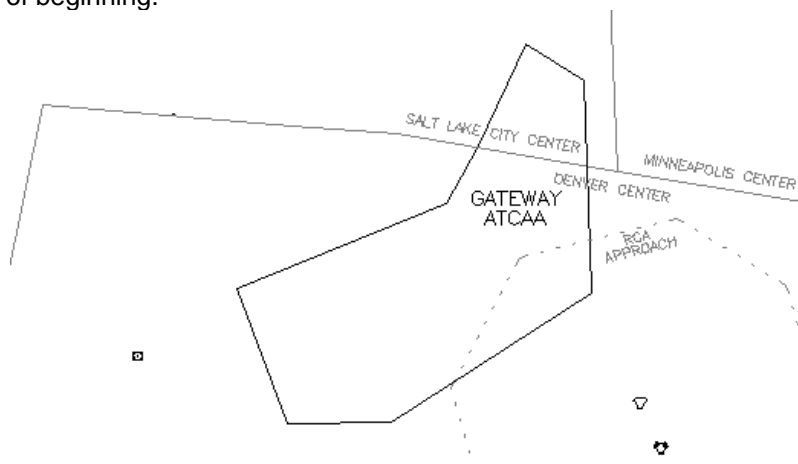
46°05'00"N - 105°12'02"W (MLS 104036) to 45°25'00"N - 103°36'02"W (RAP 331090) to 45°04'00"N - 103°51'02"W (RAP 318075) to 44°52'00"N - 104°01'02"W (RAP 308069) to 44°35'00"N - 105°03'02"W (GCC 044025) to 45°48'00"N - 105°40'02"W (MLS 146037) to the point of beginning.



The GATEWAY ATCAA is designated from FL180 through FL260 inclusive, or as assigned. The boundaries are:

Beginning at

44°35'00"N - 105°03'02"W (GCC 044025) to 44°52'00"N - 104°01'02"W (RAP 308069) to 45°04'00"N - 103°51'02"W (RAP 318075) to 45°25'00"N - 103°36'02"W (RAP 331090) to 45°17'00"N - 103°19'02"W (RAP 338080) to 44°32'00"N - 103°19'02"W (RAP 326036) to 44°06'00"N - 104°19'02"W (RAP 265057) to 44°06'00"N - 104°49'02"W (GCC 103035) to the point of beginning.



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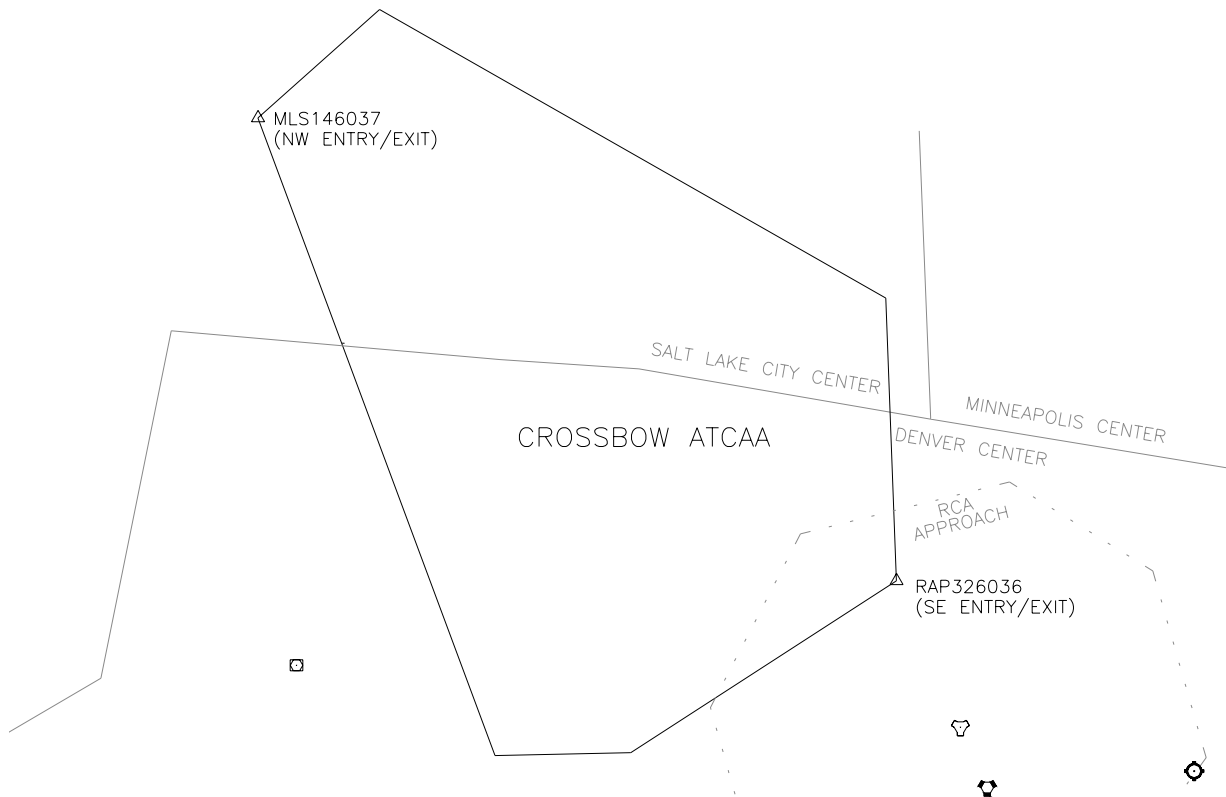
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**Attachment 3**

The **CROSSBOW ATCAA** is designated from FL270 through FL450 inclusive, or as assigned. The boundaries are:

Beginning at

46°05'00"N - 105°12'02"W (MLS 104036) to 45°17'00"N - 103°19'02"W (RAP 338080) to 44°32'00"N - 103°19'02"W (RAP 326036) to 44°06'00"N - 104°19'02"W (RAP 265057) to 44°06'00"N - 104°49'02"W (GCC 103035) to 45°48'00"N - 105°40'02"W (MLS 146037) to the point of beginning.



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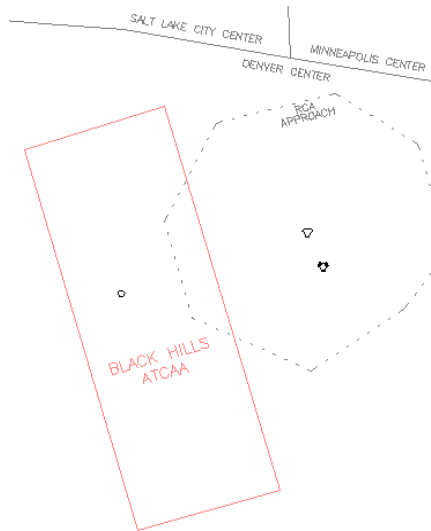
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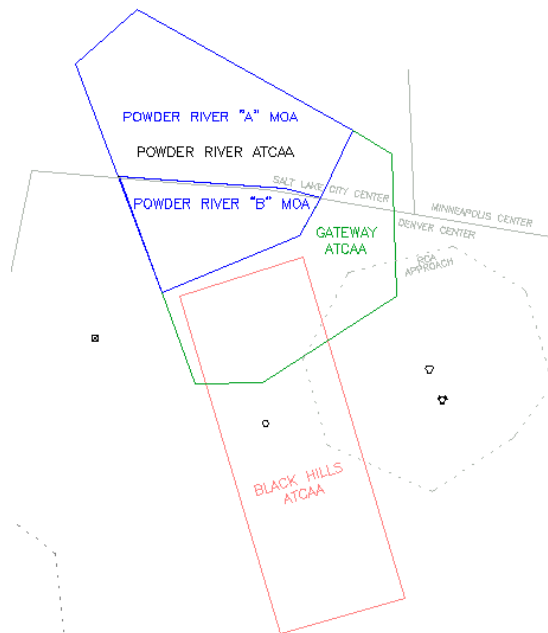
**Attachment 4**

The **BLACK HILLS ATCAA** is designated from FL200 through FL230 inclusive. The boundaries are:

Beginning at  
44°45'06"N - 104°00'00"W (RAP 305063) to 44°33'48"N - 104°54'48"W (RAP 281089) to  
42°46'12"N - 104°14'30"W (RAP 204090) to 42°56'12"N - 103°20'24"W (RAP 180064) to  
the point of beginning.



**POWDER RIVER TRAINING COMPLEX**



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**Attachment 5**

**Communications Frequencies**

Note: Radio communications are severely reduced below 16,000 feet MSL in the Powder River area.

Denver Center:

Sector 31, Powder River "B" MOA/ATCAA/Black Hills ATCAA areas below  
FL260 127.95/338.2 MHz. (If unable use 135.6 or 363.02 MHz).

Sector 32, Crossbow ATCAA above FL270  
133.67/322.5 MHz.

Tactical, 296.7 MHz.

Salt Lake City Center:

Sector 17, Powder River "A" MOA/ATCAA surface and up  
126.85/305.2 MHz.

Tactical, 364.8 MHz.

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BLM-MOU- MT925- 1001

## **MEMORANDUM OF UNDERSTANDING**

between  
Department of the Interior,  
Bureau of Land Management, Montana State Office  
and  
the United States Air Force 28<sup>th</sup> Operations Group  
Ellsworth Air Force Base, South Dakota  
concerning  
Airspace Coordination of Powder River Military Operating Area

### **1. PURPOSE**

To provide procedures and guidance for the coordination of aerial operations within Powder River A and B Military Operations Areas hereinafter referred to as PRMOA, between the 28<sup>th</sup> Operations Support Squadron, (28 OSS) of Ellsworth Air Force Base (AFB), South Dakota hereinafter referred to as 28<sup>th</sup> OSS, and the Bureau of Land Management (BLM), Miles City Dispatch Center (MCDC), Miles City, Montana hereinafter referred to as MCDC.

### **2. AUTHORITIES / REFERENCES**

Title 14 CFR, Sections 91, 73,  
Federal Aviation Administration (FAA) Order JO 7610.4M Special Operations  
Training Guide  
Federal Aviation Order JO7110.65 Air Traffic Control  
AFI 25-201, Support Agreements Procedures, 1 May 2005  
AFI 10-802, Military Support to Civil Authorities, 19 April 2002  
BLM Departmental Manual 9400  
Interagency Airspace Coordination Guide  
Taylor Grazing Act of June 28, 1924 (48 Stat. 1269; 43 U.S.C. 315)  
Federal Land Policy and Management Act of 1976, Sec. 307 (b) (43 U.S.C. 1737)  
Federal Wildland Fire Management Policy and Program Review, 1995, 2000

### **3. SCOPE**

This MOU applies to PRMOA airspace managed and controlled by the 28<sup>th</sup> OSS for joint-use by military aircraft of all service branches.

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The MCDC authorities are responsible for conducting and coordinating aerial operations within the PRMOA airspace. All aircraft under BLM operational control shall adhere to Title 14 CFR Parts 91, 133, 137 and this document.

**4. ADMINISTRATION**

Nothing in this MOU shall obligate the BLM or the United States Air Force to expend appropriations or to enter into any contract or other obligation. Specific work projects or activities that involve the transfer of funds, services, or property between the parties to this MOU will require the execution of separate agreements or contracts, contingent upon the availability of funds as appropriated by Congress. Each subsequent agreement or arrangement involving the transfer of funds, services, or property shall be made in writing and shall be independently authorized by appropriate statutory authority and regulations, including those applicable to procurement activities.

Any records or documents generated as a result of this MOU shall become part of the official BLM record maintained in accordance with applicable BLM Records Management policies. Any request for release of records associated with the implementation of this MOU to anyone outside the parties must be determined based on applicable laws, including the Freedom of Information Act and the Privacy Act. The BLM cannot agree to maintain the confidentiality of information received from the Cooperating Agency except to the extent that it is permitted under the Freedom of Information Act and the Privacy Act.

**5. RESPONSIBILITIES**

**A. The BLM is responsible for the following:**

- a. MCDC services as the focal point and primary contact for the coordination of all BLM aerial operations to include the issuance and cancellation of Temporary Flight Restrictions (TFRs), Title 14 CFR Section 91.193. The BLM shall also be responsible for informing 28<sup>th</sup> OSS of any TFR changes.
- b. Contact 28<sup>th</sup> OSS, as appropriate, to obtain prior approval for aircraft having an operational need to operate during Wildland fire incidents or other emergency operations within the PRMOA using the National Firefighting transponder Code of 1255.
- c. Provide the 28<sup>th</sup> OSS with the up-to-date information concerning BLM activity within the PRMOA when requested.
- d. Initiate the notification process for BLM activities affecting PRMOA in accordance with Flight Information publication (FLIP) AP/1B.



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- e. The BLM Montana Dakotas State Aviation Manager or assigned agency airspace coordination specialist shall:
  - 1. Be the focal point for resolving difficulties in in scheduling airspace with the 28<sup>th</sup> OSS.
  - 2. Coordination with 28th OSS Airspace Manager on all conflicts or incidents occurring within PRMOA.
  - 3. Service as the focal point for administrative change sor additiosn to the MOU.

**B. The 28<sup>th</sup> Operations Support Squadron will be responsible for:**

- a. Ensure TFR information is distributed to all flying unties utilizing the PRMOA.
- b. Coordinate routine requests from BLM dispatchers that need to conduct aviation operation within PRMOA with other affected agencies.
- c. Provide BLM with the up-too-date schedule information concerning DOD activity within the PRMOA when requested.
- d. The Airspace manager at Ellsworth AFB is the Military focal point for administrative changes or additions to this document.
- e. Provide BLM with a current copy of the 28 BW "Mid-Air Collision Avoidance (MACA) Program Guide"

**6. COORDINATION PROCIEDRUES FOR NON-FIRE OPERATIONS**

**A. BLM Requirements:**

When BLM dispatchers or aviation managers become aware of situations that my necessitate flight within the PRMOA , they shall:

- a. Coordinate all BLM aviation operations affecting PRMOA with 28th OSS in a timely manner.
- b. A pre-flight briefing of BLM aircrews will include scheduled PRMOA activity.
- c. Notify 28th OSS of the completion of all flight activity at the end of each day as appropriate.

- B. The 28th OSS, upon notification of BLM proposed aerial operations within PRMOA will:**
- a. Update military units scheduled for PRMOA, of non-military aviation operations scheduled for simultaneous activity. This advisory will include times, altitudes, and locations of non-military operations as well as a de-confliction plan.
  - b. Coordinate the current airspace status with MCDC and any scheduled flights for the requested time period.
  - c. Advise MCDC of any changes in PRMOA status that will not be conducive to joint operations and provide an estimate when operations can begin, or be resumed.

**7. COORDINATION PROCEDURES FOR FIRE RESPONSE WITH (TFR): The BLM shall:**

- a.) Check status of PRMOA airspace using the FAA Special Use Area (SUA) website and confirm with 28<sup>th</sup> OSS.
- b.) Notify 28<sup>th</sup> OSS of a fire location or upon the request of a TFR within the PRMOA
- c.) Request a TFR with the appropriate FAA Air Route Traffic Control Center (ARTCC).
- d.) Advise 28<sup>th</sup> OSS of any modification, changes, or cancellation of the TFR.

**8. CANCELLATION OF TFRs**

The TFRs will be canceled by BLM through established procedures at the appropriate ARTCC. The MCDC will notify 28<sup>th</sup> OSS, as appropriate, when air operations for the TFR are complete.

**9. INCIDENT /ACCIDENT**

In the event of an airspace incident involving BLM and DOD aircraft, the BLM and 28th OSS will notify the other agency immediately.

The BLM and the 28th OSS will follow their standard incident/accident or hazard reporting procedures and coordinate appropriately as needed.

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Incidents shall be cooperatively reviewed between the BLM and Ellsworth AFB and reported appropriately.

**10. EDUCATION AND AWARENESS**

Education and awareness is essential to the mutual efforts to enhance interagency flight safety. Meetings between BLM and USAF personnel are encouraged to foster open communication.

**11. POINTS OF CONTACT:**

**Ellsworth AFB**

28<sup>th</sup> Operations Support Squadron  
Scott Drive, Suite 200  
Ellsworth AFB, SD 57706-4710

**Airspace Manager**

Office 605-385-1230  
Fax Unclassified 605-685-1241  
After hours 605-431-3580

**28<sup>th</sup> OSS Scheduling**

Office 605-352-4746  
After hours 605-431-3025

**BLM Aviation Management**

**Montana Dakotas Aviation Office**

**Aviation Officer**

1299 Rim Top Drive  
Billings, MT 59105  
Work: 406-896-2912

**BLM Miles City Fire Operations Zone**

111 Garryowen Road  
Miles City, MT 59301

Miles City Dispatch Center

**Dispatch Office**

Normal Hours 406-233-2900  
After Hours 406-233-0148  
Fax 406-233-2945

**Unit Aviation Officer**

Work: 406-233-2909

**Center Manager**

Office 406-233-2905

**Aircraft Dispatcher**

Office 406-233-2908



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***APPENDIX N***  
***GOVERNMENT-TO-GOVERNMENT***  
***AND SECTION 106 CORRESPONDENCE***

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## SUMMARY OF FORMAL TRIBAL COMMUNICATIONS

Several laws and regulations address the requirement of federal agencies to notify or consult with American Indian tribes or otherwise consider their interests when planning and implementing federal undertakings. A series of letters, emails, and phone calls were made to the four American Indian Reservations partially or wholly located under the airspace—the Crow Indian Reservation, the Northern Cheyenne Indian Reservation, the Standing Rock Indian Reservation, and the Cheyenne River Reservation. Letters drafted by the Department of the Air Force were mailed to each Tribal Historic Preservation Office (THPO) and relevant Bureau of Indian Affairs offices in addition to tribal councils, tribal chairmen, and committees in order to inform of the proposed Powder River Training Complex (PRTC) airspace and inquire about the arrangement of government to government meetings, and ask how tribal lands might be affected by the project.

Table N-1 is a summary of all formal contact with the Crow, Northern Cheyenne, Standing Rock Sioux, and Cheyenne River Sioux Tribes. Next is a series of tables summarizing e-mails (Table N-2), and letters to other Tribes (Table N-3), as well as a list of formal Section 106 Consultation correspondence to public agencies (Table N-4).

**Table N-1. Summary of Formal Contacts by Ellsworth AFB with Crow, Northern Cheyenne, Standing Rock Sioux, and Cheyenne River Sioux Tribes**

<i>Date of Contact</i>	<i>Type of Contact</i>	<i>Contact Information</i>	<i>Comments</i>
<b>Crow Tribe</b>			
15 Feb 2008	Letter	Col Vander Hamm to Chairman Venne	Requesting Government-to-Government Consultation Regarding PRTC (prior to Notice of Intent)
09 May 2008	Visit	Col Vander Hamm to Crow Agency	Prior to Notice of Intent; Briefed Tribal Secretary Mr. Old Coyote (assigned as PRTC POC) and Chairman Black Eagle
12 Jun 2008	Letter	ACC/A7 to Crow Legal Counsel	Requesting Information to be Used for EIS
23 Jun 2008	Scoping Meeting	Held in Crow Agency	Chairman Black Eagle Spoke of Future Coal Gasification Plant and Pipeline to RCA
05 Aug 2009	Letter	Col Taliaferro to Chairman Venne	Introduction and Request to Continue Consultations and Invitation to Visit RCA
13 Jul 2010	Letter	Col Taliaferro to Mr. Old Horn (THPO)	Introducing the Section 106 Document from ACC/A7 and upcoming Public Hearings
25 Oct 2010	Public Hearing	Col Hiss was Wing Rep (Held in Crow Agency)	A Statement of Support for PRTC was given by Mr. Scott Russell (Secretary, Crow Nation)
05 Oct 2011	Letter	Col Weatherington to Chairman Black Eagle	Introduction Letter, Effects, Offer of Contact and Contact Information
12 Jan 2012	Letter	Col Weatherington to Chairman Black Eagle	Update, Summary, Thank you for Support, Offer of Contact and Contact Information
20 Aug 2012	Letter	Col Weatherington to Mr. Hubert Two Leggins (THPO)	Invitation to ACHP Hosted Virtual Consultation #1
21 Sep 2012	Virtual Consultation #1	No participation noted	

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**Table N-1. Summary of Formal Contacts by Ellsworth AFB with Crow, Northern Cheyenne, Standing Rock Sioux, and Cheyenne River Sioux Tribes**

<i>Date of Contact</i>	<i>Type of Contact</i>	<i>Contact Information</i>	<i>Comments</i>
02 Nov 2012	Letter	Col Weatherington to Mr. Hubert Two Leggins (THPO)	Invitation to ACHP Hosted Virtual Consultation #2 and #3
30 Nov 2012	Virtual Consultation #2	No participation noted	
12 Apr 2013	Letter	Col. Kennedy to Chairman Old Coyote	Intro Letter, Thank you for Support, Request for Consultation, Announce Bear Butte Avoidance Procedure
25 Jun 2013	Visit	Col. Kennedy to Crow Agency	Meeting with Chairman Old Coyote, Chairman Old Coyote Confirmed Crow Support for PRTC to Include 500' and Agreed to Work PA
06 Nov 2013	Package	Col. Kennedy to Vice Secretary Backbone	PRTC NHPA Section 106 PA with supporting documentation for coordination – With CC Cover Letter
30 Jun 2014	Package	Col. Kennedy to Vice Secretary Backbone	PRTC NHPA Section 106 PA with supporting documentation Read-Ahead – With CC Cover Letter
08 Jul 2014	Package	Col. Kennedy to Vice Secretary Backbone	PRTC NHPA Section 106 PA Request for signature – With CC Cover Letter
<b>Major Conflicting Events</b>			
<ul style="list-style-type: none"> <li>- Little Bighorn Battlefield National Monument (coordinated through NPS)</li> <li>- Crow Fair Powwow and Rodeo (August 15-19, 2013)</li> <li>- Crow Native Days (with LBH Reenactment) June 21-23, 2013</li> <li>- Sundance and other sacred ceremonies</li> </ul>			
<b>Northern Cheyenne Tribe</b>			
15 Feb 2008	Letter	Col. Vander Hamm to President Wolfname	Requesting Government-to-Government Consultation Regarding PRTC (prior to Notice of Intent)
09 May 2008	Visit	Col. Vander Hamm to Lame Deer	Briefed President Small (prior to Notice of Intent)
12 Jun 2008	Letter	ACC/A7 to Northern Cheyenne Legal Counsel	Requesting Information to be Used for EIS
24 Jun 2008	Scoping Meeting		Held in Lame Deer
28 Jul 2008	Letter	President Small to ACC/A7	
08 Sep 2008	Letter	President Small to ACC/A7	
05 Aug 2009	Letter	Col. Taliaferro to President Spang	Introduction and Request to Continue Consultations and Invitation to Visit RCA
17 Aug 2009	Government-to-Government Meeting	Col. Taliaferro and Full Tribal Council	
13 Jul 2010	Letter	Col Taliaferro to Mr. Fisher (THPO)	Introducing the Section 106 Document from ACC/A7 and Upcoming Public Hearings
07 Dec 2010	Public Hearing	Col Hiss was Wing Rep	Held in Lame Deer
22 Dec 2010	Letter	President Spang to ACC/A7	Tribal Council Resolution Requesting the No-Action Alternative
05 Oct 2011	Letter	Col. Weatherington to President Spang	Introduction Letter, Effects, Offer of Contact and Contact Information

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**Table N-1. Summary of Formal Contacts by Ellsworth AFB with Crow, Northern Cheyenne, Standing Rock Sioux, and Cheyenne River Sioux Tribes**

<i>Date of Contact</i>	<i>Type of Contact</i>	<i>Contact Information</i>	<i>Comments</i>
12 Jan 2012	Letter	Col. Weatherington to President Spang	Update, summary, thank you for support, offer of contact and contact information
20 Aug 2012	Letter	Col. Weatherington to Mr. Conrad Fisher (THPO)	Invitation to ACHP Hosted Virtual Consultation #1
21 Sep 2012	Virtual Consultation #1	Attended by Mr. Conrad Fisher (THPO)	
02 Nov 2012	Letter	Col. Weatherington to Mr. Conrad Fisher (THPO)	Invitation to ACHP Hosted Virtual Consultation #2 and #3
30 Nov 2012	Virtual Consultation #2	Attended by Mr. Conrad Fisher (THPO)	
12 Apr 2013	Letter	Col. Kennedy to President Robinson	Intro Letter, Request for Consultation, Announcement of Bear Butte Avoidance Procedure
06 Nov 2013	Package	Col. Kennedy to President Fisher	PRTC NHPA Section 106 PA with supporting documentation for coordination – With CC Cover Letter
30 Jun 2014	Package	Col. Kennedy to President Fisher	PRTC NHPA Section 106 PA with supporting documentation Read-Ahead – With CC Cover Letter
08 Jul 2014	Package	Col. Kennedy to President Fisher	PRTC NHPA Section 106 PA Request for signature – With CC Cover Letter
<b>Major Conflicting Events</b>			
<ul style="list-style-type: none"> <li>- American Indian World Peace Day</li> <li>- 4<sup>th</sup> of July Chiefs Powwow and Rodeo Celebration</li> <li>- White River Christmas Powwow</li> <li>- Sundance and other sacred ceremonies</li> </ul>			
<b>Standing Rock Sioux Tribe</b>			
15 Feb 2008	Letter	Col. Vander Hamm to Chairman His Horse Is Thunder	Requesting Government-to-Government Consultation Regarding PRTC (prior to Notice of Intent)
17 Apr 2008	Visit @ RCA	Col. Vander Hamm hosted Mr. Richard Bird, Mr. Frank White Bull, Mr. Frank Jamerson	Briefings and Base Tour (prior to Notice of Intent)
12 Jun 2008	Letter	ACC/A7 to Standing Rock Economic Committee	Information Request
11 Jul 2008	2 Scoping Meetings		Held in Fort Yates, ND and McLaughlin, SD
05 Oct 2008	Resolution		Council Resolution #670-08 Opposing PRTC (see 2 Feb 2012)
05 Aug 2009	Letter	Col. Taliaferro to Chairman His Horse Is Thunder	Introduction and Request to Continue Consultations and Invitation to Visit RCA
13 Jul 2010	Letter	Col. Taliaferro to Ms. Young, THPO	Introducing the Section 106 Document from ACC/A7 and Upcoming Public Hearings
27 Sep 2010	Public Hearing	Col. Eldridge was Wing Rep	Held in Fort Yates
11 Oct 2010	Letter	Chairman Murphy to ACC/A7	Requesting 30 Day Extension to Comment Period
09 Dec 2010	Letter	Chairman Murphy to ACC/A7	Corrections to the Draft EIS

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**Table N-1. Summary of Formal Contacts by Ellsworth AFB with Crow, Northern Cheyenne, Standing Rock Sioux, and Cheyenne River Sioux Tribes**

<i>Date of Contact</i>	<i>Type of Contact</i>	<i>Contact Information</i>	<i>Comments</i>
12 Jan 2012	Letter	Col. Weatherington to Chairman Murphy	Update, Summary, Thank you for Support, Offer of Contact and Contact Information
20 Feb 2012	Letter	Chairman Murphy to Col. Weatherington	Re-affirmed Council Resolution #670-08 Opposing PRTC
20 Aug 2012	Letter	Col. Weatherington to Ms. Wašté Wiŋ Young (THPO)	Invitation to ACHP Hosted Virtual Consultation #1
21 Sep 2012	Virtual Consultation #1	Attended by Ms. Phyllis Young, Council Member and Ms. Wašté Wiŋ Young, (THPO)	
02 Nov 2012	Letter	Col Weatherington to Ms. Wašté Wiŋ Young (THPO)	Invitation to ACHP Hosted Virtual Consultation #2 and #3
30 Nov 2012	Virtual Consultation #2	Attended by Mr. Terry Clouthier	
19 Dec 2012	Letter	Ms. Wašté Wiŋ Young (THPO) to Col. Weatherington	Requesting Face-to-Face Meeting
19 Dec 2012	Letter	Col. Weatherington to Ms. Wašté Wiŋ Young (THPO)	Accepting Face-to-Face Meeting Invitation
07 Feb 2013	Visit	Col. Weatherington met with Mr. Terry Clouthier (THPO Staff) and Mr. Dean DePountis (Tribal Legal)	At Fort Yates, North Dakota
12 Apr 2013	Letter	Col. Kennedy to Chairman Murphy	Intro Letter, Request for Consultation, Announcement of Bear Butte Avoidance Procedure
06 Nov 2013	Package	Col. Kennedy to Chairman Archambault	PRTC NHPA Section 106 PA with supporting documentation for coordination – With CC Cover Letter
30 Jun 2014	Package	Col. Kennedy to Chairman Archambault	PRTC NHPA Section 106 PA with supporting documentation Read-Ahead – With CC Cover Letter
08 Jul 2014	Package	Col. Kennedy to Chairman Archambault	PRTC NHPA Section 106 PA Request for signature – With CC Cover Letter
<b>Major Conflicting Events</b>			
<ul style="list-style-type: none"> <li>- Kenel, Cannon Ball, Porcupine, Little Eagle, Bear Soldier, Fort Yates, Rock Creek, Wakpala, United Tribes, and SBC Powwows</li> <li>- Chief Sitting Bull Day</li> <li>- Sundance and other sacred ceremonies</li> </ul>			
<b>Cheyenne River Sioux Tribe</b>			
15 Feb 2008	Letter	Col. Vander Hamm to Chairman Brings Plenty	Requesting Government-to-Government Consultation Regarding PRTC (prior to Notice of Intent)
28 Mar 2008	Visit	Col. Vander Hamm hosted Chairman Brings Plenty	Base Tour and PRTC Brief/Discussion at Ellsworth (prior to Notice of Intent)
27 May 2008	Visit	Col. Vander Hamm Meet with Vice-Chairman Mr. Bob Walters and Mr. Ted Knife Jr.	In Eagle Butte

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**Table N-1. Summary of Formal Contacts by Ellsworth AFB with Crow, Northern Cheyenne, Standing Rock Sioux, and Cheyenne River Sioux Tribes**

<i>Date of Contact</i>	<i>Type of Contact</i>	<i>Contact Information</i>	<i>Comments</i>
12 Jun 2008	Letter	ACC/A7 to Chairman Brings Plenty	Requesting Information to be Used for EIS
16 Jul 2008	Scoping Meeting		Held in Dupree
03 Sep 2008	Visit	Col. Vander Hamm briefed to the full Council	Additional Meeting Requested by Council in Eagle Butte
05 Aug 2009	Letter	Col. Taliaferro to Chairman Brings Plenty	Introduction and Request to Continue Consultations and Invitation to Visit RCA
13 Jul 2010	Letter	Col. Taliaferro to Mr. Vance (THPO)	Introducing the Section 106 Document from ACC/A7 and Upcoming Public Hearings
09 Dec 2010	Public Hearing	Col. Eldridge was Wing Rep	Held in Eagle Butte
18 Oct 2011	Visit	Col. Weatherington, Chairman Keckler, Mr. In the Woods	Reaffirmed Request for No-Action Alternative. However, Agreed to Draft MOA Just in Case
03 Jan 2012	Draft MOA	Sent to POC Mr. In the Woods to staff	
12 Jan 2012	Letter	Col. Weatherington to Chairman Keckler	Update, Summary, Thank you for Support, Offer of Contact and Contact Information
20 Aug 2012	Letter	Col. Weatherington to Mr. Steve Vance (THPO)	Invitation to ACHP Hosted Virtual Consultation #1
21 Sep 2012	Virtual Consultation #1	Attended by Mr. Bryce In the Woods, Council Member and Mr. Steve Vance (THPO)	
02 Nov 2012	Letter	Col. Weatherington to Mr. Steve Vance (THPO)	Invitation to ACHP Hosted Virtual Consultation #2 and #3
30 Nov 2012	Virtual Consultation #2	No participation noted	
12 April 2013	Letter	Col. Kennedy to Chairman Keckler	Intro Letter, Request for Consultation, Announcement of Bear Butte Avoidance Procedure
06 Nov 2013	Package	Col. Kennedy to Chairman Keckler	PRTC NHPA Section 106 PA with supporting documentation for coordination – With CC Cover Letter
30 Jun 2014	Package	Col. Kennedy to Chairman Keckler	PRTC NHPA Section 106 PA with supporting documentation Read-Ahead – With CC Cover Letter
08 Jul 2014	Package	Col. Kennedy to Chairman Keckler	PRTC NHPA Section 106 PA Request for signature – With CC Cover Letter
<p><u>Major Conflicting Events</u></p> <ul style="list-style-type: none"> <li>- Sundance and other sacred ceremonies</li> </ul> <p>Notes:</p> <ul style="list-style-type: none"> <li>- New Cheyenne River Health Center to open recently (geothermal heated facility)</li> <li>- Ziebach county is the poorest County in the U.S.</li> </ul>			

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<i>Recipient</i>	<i>From</i>	<i>Date</i>	<i>Subject</i>
<b><i>Cheyenne River Sioux Tribe</i></b>			
Arlin Whirlwindhorse	Chairman Brings Plenty, Cheyenne River Sioux	07 Aug 2008	Scoping Meeting Planning
Chairman Brings Plenty, Cheyenne River	Arlin Whirlwindhorse	07 Aug 2008	Scoping Meeting Planning
Steve Vance, Cheyenne River THPO <sup>1</sup>	George "Chia" Stone, PRTC Tribal Liaison	25 Jun 2010	Proposed Schedules for Public Hearings
Steve Vance, Cheyenne River THPO <sup>1</sup>	George "CHIA" Stone, PRTC Tribal Liaison	01 Jul 2010	Public Hearing Request
<sup>1</sup> Note: It was discovered via phone coordination that two E-Mails above did not get through – switched to Web Mail			
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	11 Jul 2010	Public Hearing Request
George "CHIA" Stone, PRTC Tribal Liaison	Steve Vance, Cheyenne River THPO	12 Jul 2010	Affirmative - Public Hearing
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	12 Jul 2010	Confirmed Tribe's Request for Public Hearing
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	02 Aug 2010	Sec 106 Package Receipt Confirmation
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Sep 2010	Connectivity Check
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	14 Dec 2010	Attached - Preliminary Draft MOA
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	28 Jan 2011	Status of Draft MOA from December Meeting
George "CHIA" Stone, PRTC Tribal Liaison	Steve Vance, Cheyenne River THPO	05 May 2011	Checking Dates for Proposed Meeting
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	10 May 2011	Government-to-Government Section 106 Consultation Request
George "CHIA" Stone, PRTC Tribal Liaison	Steve Vance, Cheyenne River THPO	21 Jul 2011	Status for Missouri River Flooding
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	03 Jan 2012	Attached – Draft LOA
George "CHIA" Stone, PRTC Tribal Liaison	Bryce In the Woods, Cheyenne River	03 Jan 2012	Confirmed Receipt
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	24 Jan 2012	Status Check of Draft LOA and 12 January 2012 CC Letter
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	28 Mar 2012	Status Check of Draft LOA and Announcement of PA
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	22 May 2012	Status Check of Draft LOA
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Sep 2012	ACHP Host Virtual Consultation Attached – Invite, Draft PA
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	04 Sep 2012	ACHP Host Virtual Consultation Attached – Invite, Draft PA
Chairman Keckler, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	04 Sep 2012	ACHP Host Virtual Consultation Attached – Invite, Draft PA
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Oct 2012	Proposed Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Host Virtual Consultations
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	25 Oct 2012	Proposed Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Host Virtual Consultations

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Oct 2012	Invite and Final Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Host Virtual Consultations
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	29 Oct 2012	Invite and Final Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Host Virtual Consultations
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	27 Nov 2012	Reminder of 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	27 Nov 2012	Reminder of 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Nov 2012	Reminder of 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	29 Nov 2012	Reminder of 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Bryce In the Woods, Cheyenne River	George "CHIA" Stone, PRTC Tribal Liaison	12 Dec 2012	Cancellation of 3 <sup>rd</sup> ACHP Hosted Virtual Consultation
Bryce In the Woods, PRTC POC (cc: Steve Vance, Cheyenne River THPO)	George "CHIA" Stone, PRTC Tribal Liaison	13 Feb 2014	Email confirmation. Check on status of POC Bryce In the Woods.
George "CHIA" Stone, PRTC Tribal Liaison	Steve Vance, Cheyenne River THPO	18 Feb 2014	Received new Email address and confirmed his
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	18 Feb 2014	Confirmed email update and Bryce In the Woods is no longer with the Council so also no longer PRTC POC
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	01 Jul 2014	Connectivity check
George "CHIA" Stone, PRTC Tribal Liaison	Steve Vance, Cheyenne River THPO	01 Jul 2014	Email received, will forward photos of aircraft seen overflying Cheyenne River Reservation
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	01 Jul 2014	Received, wilco on the photos
Steve Vance, Cheyenne River THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Jul 2014	Electronic copy of PA Pkg attached as requested during phone conversation
Chairman Kevin Keckler (cc: Steve Vance, Cheyenne River THPO; Bryce In the Woods, PRTC POC)	George "CHIA" Stone, PRTC Tribal Liaison	09 Jul 2014	Heads up [with respect to] PA signature request
<b>Crow Tribe</b>			
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Mar 2010	Date Request for Public Hearing
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Apr 2010	Refined Dates for Public Hearing
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	03 May 2010	Site Visit Request
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Jun 2010	Proposed Date for Public Hearing
George "CHIA" Stone, PRTC Tribal Liaison	Tim Cleary, Crow Tribe Archaeologist	06 Aug 2010	PRTC Draft EIS Review Completion – No Issues
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	06 Aug 2010	Thank you for Coordinating with Mr. Cleary - Public Hearing?
Tim Cleary, Crow Tribe Archaeologist	George "CHIA" Stone, PRTC Tribal Liaison	06 Aug 2010	Acknowledgement of EIS Review – Will Forward

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Aug 2010	Proposed Date for Public Hearing
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Apr 2011	Consultation Request
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	08 Apr 2011	Re-transmit – Connectivity Check
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	16 Nov 2011	Consultation Request
George "CHIA" Stone, PRTC Tribal Liaison	Tim Cleary, Crow Tribe Archaeologist	17 Nov 2011	Re-stated PRTC Package Receipt and Review – No Issues
Tim Cleary, Crow Tribe Archaeologist	George "CHIA" Stone, PRTC Tribal Liaison	17 Nov 2011	Thank you for Prompt Response
Dale Old Horn, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	14 Dec 2011	New E-Mail Address – Connectivity Check
George "CHIA" Stone, PRTC Tribal Liaison	Hubert Two Leggins, Crow Tribe THPO	10 Jan 2012	Letter Receipt Confirmation and Contact Information
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	10 Jan 2012	Confirmed Connectivity – Looking Forward to Ongoing Dialog
George "CHIA" Stone, PRTC Tribal Liaison	Melissa Holds the Enemy, Crow Tribe Legal Council	10 Jan 2012	Confirmed Receipt of Letter – Taken to Chairman's Secretary
Rosella Bear Don't Walk, Crow Tribe Staff	George "CHIA" Stone, PRTC Tribal Liaison	10 Jan 2012	Attached - Copy of 5 October 2011 CC Letter
George "CHIA" Stone, PRTC Tribal Liaison	Rosella Bear Don't Walk, Crow Tribe Staff	10 Jan 2012	Receipt Confirmation and Forward to Hubert Two Leggins THPO
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	11 Jan 2012	Attached - 13 July 2010 Letter and Crow Nation Cultural Report
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	27 Jan 2012	Attached - FedEx Receipt from January 2012
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	01 Feb 2012	Attached – 12 January 2012 CC Letter
Melissa Holds the Enemy, Crow Tribe Legal Council	George "CHIA" Stone, PRTC Tribal Liaison	01 Feb 2012	Attached – 12 January 2012 Letter – Thank you for Your Assistance
George "CHIA" Stone, PRTC Tribal Liaison	Melissa Holds the Enemy, Crow Tribe Legal Council	01 Feb 2012	Letter Hand Carried to Chairman's Secretary
Melissa Holds the Enemy, Crow Tribe Legal Council	George "CHIA" Stone, PRTC Tribal Liaison	01 Feb 2012	Acknowledged – Thank you for Your Assistance
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	20 Mar 2012	Requested Response from 5 October 2011 and 12 January 2012 CC Letters
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	22 May 2012	Physical Address Request from Failed Site Visit (drop-in)
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Sep 2012	Invite and Information for First ACHP Hosted Virtual Consultation
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Oct 2012	Proposed Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Host Virtual Consultations
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Oct 2012	Invite and Final Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Host Virtual Consultations
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	27 Nov 2012	Reminder for 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Nov 2012	Agenda for 2 <sup>nd</sup> ACHP Hosted Virtual Consultation



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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
Hubert Two Leggins, Crow Tribe THPO	George "CHIA" Stone, PRTC Tribal Liaison	12 Dec 2012	Cancellation of 3 <sup>rd</sup> ACHP Hosted Virtual Consultation
Patricia R, Crow Tribe Staff	George "CHIA" Stone, PRTC Tribal Liaison	10 May 2013	Attached – 12 April 2013 CC Letter – Meeting Request
Patricia R, Crow Tribe Staff (cc: John Morgenstern, 28 CES/CEIEA)	George "CHIA" Stone, PRTC Tribal Liaison	10 May 2013	Request for meeting between Col. Kennedy and Chairman Old Coyote
Patricia R, Crow Tribe Staff	George "CHIA" Stone, PRTC Tribal Liaison	20 May 2013	Status of Meeting Request
Patricia R, Crow Tribe Staff (cc: David Garrett, 28 OSS/ADO)	George "CHIA" Stone, PRTC Tribal Liaison	20 May 2013	Meeting Coordination
Patricia R, Crow Tribe Staff	George "CHIA" Stone, PRTC Tribal Liaison	06 Jun 2013	Confirming details of meeting, 25 Jun, 1300hrs, Crow Agency, Chairman's Office
Patricia R, Crow Tribe Staff	George "CHIA" Stone, PRTC Tribal Liaison	26 Jun 2013	Thank you for setting up meeting
Melissa Holds the Enemy, Crow Tribe Legal Council	George "CHIA" Stone, PRTC Tribal Liaison	26 Jun 2013	Thank you for her card at meeting. Request for contact info for Vice Secretary Backbone (named by Chairman Old Coyote as PRTC POC)
Shawn Backbone, Vice Secretary (cc: Emerson Bull Chief THPO; Melissa Holds the Enemy, Managing Attorney)	George "CHIA" Stone, PRTC Tribal Liaison	09 Jan 2014	Attached electronic copy of PA Pkg. Inquiry with respect to Tribal response to Nov PA.
Melissa Holds the Enemy, Crow Tribe Legal Council	George "CHIA" Stone, PRTC Tribal Liaison	13 Feb 2014	Email correction and inquiry with respect to Tribal response to PA (Had mentioned earlier that comments were pending).
Shawn Backbone, Vice Secretary (cc: Emerson Bull Chief THPO)	George "CHIA" Stone, PRTC Tribal Liaison	09 Jul 2014	Heads up email with respect to PA signature request
George "CHIA" Stone, PRTC Tribal Liaison	Emerson Bull Chief THPO	10 Jul 2014	Was unable to open attachment
Emerson Bull Chief THPO	George "CHIA" Stone, PRTC Tribal Liaison	10 Jul 2014	No attachment sent
<b>Northern Cheyenne Tribe</b>			
Conrad Fisher, Northern Cheyenne	Linda DeVine, ACC/A7PP	15 Sept 2008	Comments on EIS from Northern Cheyenne Tribal Council
Conrad Fisher, Northern Cheyenne	Linda DeVine, ACC/A7PP	23 Feb 2009	Possible Dates for Presentation at Tribal Council Meeting
Conrad Fisher, Northern Cheyenne	Linda DeVine, ACC/A7PP	07 July 2009	Presentation at Tribal Council Meeting on 17 August 2009
Linda DeVine, ACC/A7PP	Curtis Elkshouder, Northern Cheyenne	05 Aug 2009	Presentation at Tribal Council Meeting on 17 August 2009
Linda DeVine, ACC/A7PP	Curtis Elkshouder, Northern Cheyenne	07 Aug 2009	Presentation at Tribal Council Meeting on 17 August 2009
Conrad Fisher, Northern Cheyenne THPO	Linda DeVine, ACC/A7PS	13 Aug 2009	Attached - Preliminary Draft of MOA
Linwood Tall Bull, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Mar 2010	Connectivity Check – Site Visit Request

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
George "CHIA" Stone, PRTC Tribal Liaison	Linwood Tall Bull, Northern Cheyenne THPO	02 Apr 2010	Connectivity Confirmed – Site Visit Approved
Linwood Tall Bull, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Apr 2010	Proposed dates for Public Hearing
Linwood Tall Bull, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	03 May 2010	Site Visit Plan
George "CHIA" Stone, PRTC Tribal Liaison	Linwood Tall Bull, Northern Cheyenne THPO	03 May 2010	Site Visit Plan Confirmed
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Jun 2010	Proposed Date for Public Hearing
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	26 Jun 2010	Attached - Preliminary Draft of MOA (same as 13 August 2009)
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	26 Jun 2010	Delivery Confirmation – Section 106 Documentation Package
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	11 Aug 2010	Edits to Preliminary Draft of MOA
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	12 Aug 2010	Request Retransmit Preliminary Draft of MOA
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	12 Aug 2010	Attached - Preliminary Draft of MOA (same as 13 August 2009)
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	26 Aug 2010	Attached – Section 106 Document Package and CC Letter
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Oct 2010	Coordination Request for Public Hearing
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	11 Oct 2010	Referred to Ms. Aleda Spang
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	28 Jan 2011	Request Update on Draft MOA
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Feb 2011	Mr. Fisher's Request (by phone) to "Table" MOA Refer to Full Council
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Feb 2011	Mr. Fisher's request (by phone) to "Table" MOA Refer to Full Council
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	09 Feb 2011	Mr. Fisher Confirmed "Table" Plan
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Apr 2011	Consultation Request
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	08 Apr 2011	"No-Action Alternative" or Talk Directly to Full Council
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	05 May 2011	Request Government-to-Government Section 106 Consultation with Full Council
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	31 May 2011	Proposed Dates for Meeting, Acknowledge Flooding Threat
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	16 Nov 2011	Request Government-to-Government Section 106 Consultation with Full Council
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	20 Dec 2011	Request Government-to-Government Section 106 Consultation with Full Council
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	20 Dec 2011	Requested/Attached – 22 December 2010 Letter from President Spang
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	20 Dec 2011	Connectivity Check – Received "Recipient's Mail Box Full"

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	21 Dec 2011	Connectivity Check – Unable to Make Phone Contact
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	22 Dec 2011	Request Receipt Confirmation of all Correspondence to/from Tribe
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	30 Dec 2011	Request Receipt Confirmation of all Correspondence to/from Tribe
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	03 Jan 2012	Connectivity Check – E-Mail with Attachment (retry from 20 December)
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	03 Jan 2012	Connectivity Check – Unable to Make Phone Contact
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Jan 2012	Attachment – 10 September 2008 Letter to President Small
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Jan 2012	Attachment – 11 August 2008 Letter to President Small
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	26 Jan 2012	Attachment – FedEx Receipt from 12 January 2012 CC Letter
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	01 Feb 2012	Attachment – 12 January 1012 CC Letter
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	24 Feb 2012	Pending Resolution WRT No-Fly Over Reservation/Sacred Sites
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	05 Mar 2012	Acknowledgement
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	05 Sep 2012	Attached Invite and Draft PA – ACHP Hosted Virtual Consultation
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	21 Sep 2012	Problem Logging into ACHP Hosted Virtual Consultation
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	21 Sep 2012	Thank you for Participation in the ACHP Hosted Virtual Consultation
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	25 Sep 2012	Ack. Mr. Fisher's Dissatisfaction with Virtual Consultation Format
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Oct 2012	Proposed Dates for the 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Host Virtual Consultations
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Oct 2012	Invite and Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Hosted Virtual Consultations
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	27 Nov 2012	Acknowledge Forward of Mr. Fisher's remarks (30 Oct phone call) to Leadership
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Nov 2012	Agenda for 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	10 Jan 2013	Offer of TeleCon dates to answer his questions from 5 Dec 2012
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	20 Jan 2013	Repeat offer for TeleCon
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	13 Feb 2014	Email update. Inquired if he had had time to review the PA to see if we are making headway with respect to addressing the Northern Cheyenne Tribes concerns

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
Conrad Fisher, Northern Cheyenne THPO	David Garrett, Acting PRTC Tribal Liaison	28 Feb 2014	Thank you for your Call. Will FWD concerns regarding lack of opportunity to comment on PA and visit request. Will FWD electronic copy of PA.
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	06 Mar 2014	Thank you for contact, sent PA
Conrad Fisher, Northern Cheyenne THPO (cc: David Garret, 28 OSS/ADO)	George "CHIA" Stone, PRTC Tribal Liaison	06 Mar 2014	Thank you for working with Dave Garrett see attached PA.
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	07 Mar 2014	Thank you for follow up. Repeat request to send his office all correspondence received by my office from Northern Cheyenne Tribe.
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Mar 2014	Retransmit – Letter from President Small dated 11 Aug 2008 (attached) (originally sent Wednesday, January 04, 2012 9:44 AM)
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Mar 2014	Retransmit – Letter from President Small dated 10 Sep 2008 (attached) (originally sent Wednesday, January 04, 2012 9:39 AM)
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Mar 2014	Retransmit – Letter from President Spang dated 22 Dec 2010 (attached) (originally sent Tuesday, January 03, 2012 8:29 AM & Tuesday, December 20, 2011 12:00 PM)
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Mar 2014	3 letters forwarded
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	07 Mar 2014	Received, Thank you
Conrad Fisher, Northern Cheyenne THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Jul 2014	Coordinating dates for visit, please forward next opportunity to meet with Council or President.
President Llevando Fisher (cc: Conrad Fisher, Northern Cheyenne THPO)	George "CHIA" Stone, PRTC Tribal Liaison	09 Jul 2014	Heads up with respect to PA signature request
George "CHIA" Stone, PRTC Tribal Liaison	Conrad Fisher, Northern Cheyenne THPO	09 Jul 2014	Thank you for response. Has not reviewed PA. Reiterated Council's Resolution opposing PRTC. Insufficient Consultation. Requested Col. Kennedy Visit ASAP. Refer future coordination/consultation to President Llevando Fisher, beyond THPO authority.
<b>Standing Rock Sioux Tribe</b>			
Wašté Wı̃ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	24 Feb 2010	Connectivity Check – Contact Information
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wı̃ Young, Standing Rock THPO	24 Feb 2010	Connectivity Confirmed – Contact Information
Wašté Wı̃ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Apr 2010	Proposed Dates for Public Hearings – Public Hearing Request?
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wı̃ Young, Standing Rock THPO	09 Apr 2010	Request for Formal Letter with Dates and Options for Council

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<i>Recipient</i>	<i>From</i>	<i>Date</i>	<i>Subject</i>
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Apr 2010	Acknowledgment of Letter Request
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Jun 2010	Does Tribe want to Host a Public Hearing? Proposed Date 27 September 2010
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	02 Aug 2010	Proposed Date for Public Hearing
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	02 Aug 2010	Request Confirmation of Receipt of Section 106 Document Package and CC letter
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	12 Aug 2010	Follow up on Package, Letter, and Request for Meeting
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	16 Aug 2010	Delivery Confirmation Information
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	18 Aug 2010	Unable to Find Package
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	18 Aug 2010	Package Found (DEIS) but not 106 Package
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	18 Aug 2010	Attached - Scanned Copies – Section 106 Document Package and CC Letter
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	25 Aug 2010	Firm Date for Public Hearing
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Sep 2010	Tentative Date 27 September – Looking to Finalize Details with Tribe
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	09 Sep 2010	Public Hearing to be LIVE on Tribal Radio
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	09 Sep 2010	Date Confirmed – Location and Time TBD (from Tribe)
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	15 Sep 2010	Status Check on Public Hearing
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	16 Sep 2010	Firmed up Date, Still Awaiting Time/Location from Tribe
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	07 Apr 2011	Consultation Request with Prospective Dates
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	02 May 2011	June Looks Best for Meeting thus Far
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	02 May 2011	Request 2 Meetings Staff Level (June), Leaders (Government-to-Government) 2-3 weeks later
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	31 May 2011	Has Meeting Plan been Overcome by Flooding?
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	06 Jun 2011	Flooding will Not Allow Meeting Plan Now
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	06 Jun 2011	Acknowledgment – Request Consultation when Able
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	21 Jul 2011	Status Check – Flood Waters Receding
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	17 Oct 2011	Status Check – Request Government-to-Government Section 106 Consultation
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	20 Oct 2011	Acknowledged – will Forward Request to Council

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	21 Oct 2011	Council Requests Dates, Additional Public (Educational) Meetings
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	31 Oct 2011	Request Government-to-Government Section 106 Consultation ASAP
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	16 Nov 2011	Status Check – request Government-to-Government Section 106 Consultation
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	06 Dec 2011	Status Check – request Government-to-Government Section 106 Consultation
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Sep 2012	Additional information on the Virtual Consultation
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	14 Sep 2012	Attached – Invite to Virtual Consultation and Draft PA
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	19 Sep 2012	Information on ACHP Hosted Virtual Consultation
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	19 Sep 2012	Will be attending the ACHP Hosted Virtual Consultation
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	19 Sep 2012	Attendees Still Pending for ACHP Hosted Virtual Consultation
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	25 Oct 2012	Tentative Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Hosted Virtual Consultations
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Oct 2012	Firm Dates for 2 <sup>nd</sup> and 3 <sup>rd</sup> ACHP Hosted Virtual Consultations
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	27 Nov 2012	Reminder/ Information for 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	29 Nov 2012	Agenda for 2 <sup>nd</sup> ACHP Hosted Virtual Consultation
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	12 Dec 2012	Cancellation of 3 <sup>rd</sup> ACHP Hosted Virtual Consultation
George "CHIA" Stone, PRTC Tribal Liaison	Terry Clouthier, Standing Rock Archaeologist	30 Nov 2012	Request for Physical Address for Correspondence
Terry Clouthier, Standing Rock Archaeologist	George "CHIA" Stone, PRTC Tribal Liaison	30 Nov 2012	Included Physical Address for Correspondence
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	04 Jan 2013	Confirmation of 7 Feb 2012 meeting with Col. Weatherington in Fort Yates
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Feb 2013	Confirmation of attendees from Ellsworth coming to the 7 Feb Meeting
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	04 Feb 2013	Lunch recommendation Prairie Knights Casino 15 miles North of Fort Yates
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	04 Feb 2013	Change meeting location to Prairie Knights Casino (Business Lunch)
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	04 Feb 2013	Thank you and accept new location
George "CHIA" Stone, PRTC Tribal Liaison	Shauna Elk, Standing Rock THPO Staff	05 Feb 2013	Confirmation of meeting details
Shauna Elk, Standing Rock THPO Staff	George "CHIA" Stone, PRTC Tribal Liaison	05 Feb 2013	Thank you and confirm details
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	06 Feb 2013	Requested Updated Copy of the Draft PA
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	06 Feb 2013	Previous edition from Virtual Consult is still current

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**Table N-2. Summary of all E-Mails To and From Tribal Groups**

<b>Recipient</b>	<b>From</b>	<b>Date</b>	<b>Subject</b>
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	08 Feb 2013	Thank you for meeting. Thanks to Terry and Dean for staying when all else were called away to Bismarck. Request dates full Council would be available for meeting.
Wašté Wiŋ Young, Standing Rock THPO (cc: Shauna Elk, Standing Rock THPO staff)	George "CHIA" Stone, PRTC Tribal Liaison	01 Mar 2013	Follow up on possible dates for full council meeting
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	08 Jan 2014	Announcement of Chairman Dave Archambault II
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	08 Jan 2014	Inquiry with respect to Tribal response from November PA
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	08 Jan 2014	Will meet with Chairman Archambault next week to discuss and get back to you
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	08 Jan 2014	Thank you for your continued efforts
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	13 Jan 2014	Request text version of PA for Chairman's review
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	28 Jan 2014	Restated request
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	28 Jan 2014	Apology, document attached, new email address included.
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	13 Feb 2014	Check on Chairman's review/comments, and ensure new email address receipt
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	19 Feb 2014	New email received. Test, please respond. Will be submitting comments on PA
Wašté Wiŋ Young, Standing Rock THPO	George "CHIA" Stone, PRTC Tribal Liaison	19 Feb 2014	Received okay
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	19 Feb 2014	Acknowledgement. Will be submitting comments on PA
Wašté Wiŋ Young, Standing Rock THPO (cc: David Garrett, 28 OSS/ADO)	George "CHIA" Stone, PRTC Tribal Liaison	19 Feb 2014	Coordinating POC while on leave
George "CHIA" Stone, PRTC Tribal Liaison	Wašté Wiŋ Young, Standing Rock THPO	19 Feb 2014	Acknowledgement
Chairman Dave Archambault II Sent via – A. Cordova	George "CHIA" Stone, PRTC Tribal Liaison	10 Jul 2014	Heads up with respect to PA signature request
<b>Rosebud Sioux Tribe</b>			
Kathe Arcoren, Rosebud Sioux	Linda DeVine, ACC/A7PP	08 Aug 2008	THPO at Rosebud
John Morgenstern, Natural and Cultural Resource Manager, Ellsworth AFB	Kathe Arcoren, Rosebud Sioux	29 Mar 2011	Powder River Training Complex Meeting
Kathe Arcoren, Rosebud Sioux	John Morgenstern, Natural and Cultural Resource Manager, Ellsworth AFB	05 April 2013	Update on Section 106 Tribal Consultations

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**Table N-3. Summary of all Letters Sent To and From Other Tribal Groups**

<i>Recipient</i>	<i>From</i>	<i>Date of Contact</i>
Chippewa-Cree Business Committee	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Turtle Mountain Tribal Council	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Three Affiliated Tribes Business Council	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Eastern Shoshone Tribal Council	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Rosebud Sioux Tribe	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Arapaho Business Council	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Oglala Sioux Tribal Council	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Confederated Salish and Kootenai Tribe	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Fort Belknap Community Council	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Fort Peck Tribal Executive Board	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Spirit Lake Sioux Tribal Council	Department of the Air Force – HQ ACC-A7PP	03 June 2008
Bruce W. MacDonald, P. E. Department of the Air Force Headquarters Air Combat Command, A7P	Bureau of Indian Affairs Great Plains Regional Office	08 July 2008
Linda DeVine, PRTC EIS Manager, Langley AFB, VA	Rosebud Sioux Tribe	31 July 2008

**Table N-4. Section 106 Agency Correspondence**

<i>Recipient</i>	<i>From</i>	<i>Date of Contact</i>
Donald Red Thunder Land Operations Office Cheyenne River Agency	Department of the Air Force – HQ ACC-A7PP	12 June 2008
Bureau of Indian Affairs Standing Rock Agency	Department of the Air Force – HQ ACC-A7AP	03 June 2008
Bureau of Indian Affairs Cheyenne River Agency	Department of the Air Force – HQ ACC-A7AP	03 June 2008
Bureau of Indian Affairs Pine Ridge Agency	Department of the Air Force – HQ ACC-A7AP	03 June 2008
Bureau of Indian Affairs Rocky Mountain Regional Office	Department of the Air Force – HQ ACC-A7AP	03 June 2008
Bureau of Indian Affairs Midwest Regional Office	Department of the Air Force – HQ ACC-A7AP	03 June 2008
Bureau of Indian Affairs Great Plains Regional Office	Department of the Air Force – HQ ACC-A7AP	03 June 2008
South Dakota State Historic Society	Department of the Air Force – HQ ACC-A7AP	03 June 2008
State Historical Society of North Dakota	Department of the Air Force – HQ ACC-A7AP	03 June 2008



**Table N-4. Section 106 Agency Correspondence**

<b>Recipient</b>	<b>From</b>	<b>Date of Contact</b>
State Parks and Cultural Resource Preservation Office (Wyoming)	Department of the Air Force– HQ ACC-A7AP	03 June 2008
Montana Historical Society	Department of the Air Force– HQ ACC-A7AP	03 June 2008
Karen Breslin National Park Service, Intermountain Region	Department of the Air Force – HQ ACC-A7P	03 June 2008
Pat Rooney National Park Service, Midwest Region	Department of the Air Force – HQ ACC-A7P	03 June 2008
Vicki McCuster National Park Service, Natural Sounds Program	Department of the Air Force – HQ ACC-A7P	03 June 2008
Linda DeVine Department of the Air Force PRTC EIS Manager	South Dakota Department of Tourism and State Development	07 July 2008
Linda DeVine Department of the Air Force PRTC EIS Manager	National Park Service Midwest Region	07 August 2008
Nancy Brown Advisory Council on Historic Preservation	Mr. John Morgenstern Natural/Cultural Resources Manager Department of the Air Force 28 CES/CEVP Ellsworth AFB, SD 57706	01 December 2008
Mr. John Morgenstern Natural/Cultural Resources Manager Department of the Air Force 28 CES/CEVP Ellsworth AFB, SD 57706	Raymond V. Wallace Historic Preservation Technician Federal Property Management Section Office of Federal Agency Programs	03 December 2008
Nancy Brown Advisory Council on Historic Preservation	Mr. John Morgenstern Natural/Cultural Resources Manager Department of the Air Force 28 CES/CEVP	04 February 2009

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*Final*  
*November 2014*



**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

15 Feb 08

Colonel Scott A. Vander Hamm  
Commander, 28<sup>th</sup> Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Rick Wolfname, President  
Northern Cheyenne Tribal Council  
P.O. Box 128  
Lame Deer MT 59043

Dear President Wolfname

I respectfully request a Government-to-Government consultation to discuss a proposal to establish a Military Operations Area (MOA) (Atch 1), in an area that overlies the Northern Cheyenne Indian Reservation.

The 28th Bomb Wing would prefer to personally meet with you and discuss the proposed airspace modifications and alternatives to the proposal to meet training needs of B-1 pilots at Ellsworth AFB SD and B-52 pilots from Minot AFB ND prior to the Air Force publicly releasing a Notice of Intent to prepare an Environmental Impact Statement. Public notification is tentatively scheduled for spring of 2008 and numerous public scoping meetings are being planned shortly after in the affected areas of Montana, Wyoming, North Dakota, and South Dakota (list attached). The scoping meetings were chosen based on their location to the proposed action and in areas we feel would obtain the most comprehensive public outreach. If you would like the Air Force to hold a separate scoping meeting for members of the Northern Cheyenne Tribe, please let me know or have a representative contact Ms. Linda DeVine (Air Combat Command Project Manager) at 757-764-9434 by March 10, 2008 to discuss details.

The scoping meetings will be held in an open-house format where Air Force representatives will describe the proposed action and alternatives, the National Environmental Policy Act process which we are undertaking, outline opportunities for public involvement, and answer questions the public might have on the proposal. Public notification and details of the scoping meetings will be published in the Federal Register and local papers in advance.

Please contact me at (605) 385-2801 or 1Lt Lauren Wright, public affairs, at (605) 385-5056.

Sincerely,

A handwritten signature in black ink that reads "Scott A. Vander Hamm".

SCOTT A. VANDER HAMM, COLONEL, USAF

Attachments:  
Map  
Scoping Locations

*Global Power For America*

*Final*  
*November 2014*



**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

15 Feb 08

Colonel Scott A. Vander Hamm  
Commander, 28<sup>th</sup> Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Joseph Brings Plenty, Chairman  
Cheyenne River Sioux Tribe  
P.O. Box 590  
Eagle Butte SD 57625

Dear Chairman Brings Plenty

I respectfully request a Government-to-Government consultation to discuss a proposal to establish a Military Operations Area (MOA) (Atch 1), in an area that overlies a portion of the Cheyenne River Indian Reservation.

The 28th Bomb Wing would prefer to personally meet with you and discuss the proposed airspace modifications and alternatives to the proposal to meet training needs of B-1 pilots at Ellsworth AFB SD and B-52 pilots from Minot AFB ND prior to the Air Force publicly releasing a Notice of Intent to prepare an Environmental Impact Statement. Public notification is tentatively scheduled for spring of 2008 and numerous public scoping meetings are being planned shortly after in the affected areas of Montana, Wyoming, North Dakota, and South Dakota (Atch 2). The scoping meetings were chosen based on their location to the proposed action and in areas we feel would obtain the most comprehensive public outreach. If you would like the Air Force to hold a separate scoping meeting for members of the Cheyenne River Sioux Tribe, please let me know or have a representative contact Ms. Linda DeVine (Air Combat Command Project Manager) at 757-764-9434 by March 10, 2008 to discuss details.

The scoping meetings will be held in an open-house format where Air Force representatives will describe the proposed action and alternatives, the National Environmental Policy Act process which we are undertaking, outline opportunities for public involvement, and answer questions the public might have on the proposal. Public notification and details of the scoping meetings will be published in the Federal Register and local papers in advance.

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Sincerely

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SCOTT A. VANDER HAMM, COLONEL, USAF

Attachments:  
Map  
Scoping Locations

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November 2014*



**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

15 Feb 08

Colonel Scott A. Vander Hamm  
Commander, 28<sup>th</sup> Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Ron His Horse Is Thunder, Chairman  
Standing Rock Sioux Tribal Council  
P.O. Box D  
Fort Yates ND 58538

Dear Chairman His Horse is Thunder

I respectfully request a Government-to-Government consultation to discuss a proposal to establish a Military Operations Area (MOA) (Atch 1), in an area that overlies or a portion of the Standing Rock Indian Reservation.

The 28th Bomb Wing would prefer to personally meet with you and discuss the proposed airspace modifications and alternatives to the proposal to meet training needs of B-1 pilots at Ellsworth AFB SD and B-52 pilots from Minot AFB ND prior to the Air Force publicly releasing a Notice of Intent to prepare an Environmental Impact Statement. Public notification is tentatively scheduled for spring of 2008 and numerous public scoping meetings are being planned shortly after in the affected areas of Montana, Wyoming, North Dakota, and South Dakota (Atch 2). The scoping meetings were chosen based on their location to the proposed action and in areas we feel would obtain the most comprehensive public outreach. If you would like the Air Force to hold a separate scoping meeting for members of the Standing Rock Sioux Tribe, please let me know or have a representative contact Ms. Linda DeVine (Air Combat Command Project Manager) at 757-764-9434 by March 10, 2008 to discuss details.

The scoping meetings will be in held in an open-house format where Air Force representatives will describe the proposed action and alternatives, the National Environmental Policy Act process which we are undertaking, outline opportunities for public involvement, and answer questions the public might have on the proposal. Public notification and details of the scoping meetings will be published in the Federal Register and local papers in advance.

Please contact me at (605) 385-2801 or 1Lt Lauren Wright, public affairs, at (605) 385-5056.

Sincerely

A handwritten signature in black ink that reads "Scott A. Vander Hamm".

SCOTT A. VANDER HAMM, COLONEL, USAF

Attachments:  
Map  
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**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

15 Feb 08

Colonel Scott A. Vander Hamm  
Commander, 28<sup>th</sup> Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Carl Venne, Chairman  
Crow Tribal Council  
P.O. Box 169  
Crow Agency MT 59022

Dear Chairman Venne

I respectfully request a Government-to-Government consultation to discuss a proposal to establish a Military Operations Area (MOA) (Atch 1), in an area that overlies a portion of the Crow Indian Reservation.

The 28th Bomb Wing would prefer to personally meet with you and discuss the proposed airspace modifications and alternatives to the proposal to meet training needs of B-1 pilots at Ellsworth AFB SD and B-52 pilots from Minot AFB ND prior to the Air Force publicly releasing a Notice of Intent to prepare an Environmental Impact Statement. Public notification is tentatively scheduled for spring of 2008 and numerous public scoping meetings are being planned shortly after in the affected areas of Montana, Wyoming, North Dakota, and South Dakota (Atch 2). The scoping meetings were chosen based on their location to the proposed action and in areas we feel would obtain the most comprehensive public outreach. If you would like the Air Force to hold a separate scoping meeting for members of the Crow Tribe, please let me know or have a representative contact Ms. Linda DeVine (Air Combat Command Project Manager) at 757-764-9434 by March 10, 2008 to discuss details.

The scoping meetings will be held in an open-house format where Air Force representatives will describe the proposed action and alternatives, the National Environmental Policy Act process which we are undertaking, outline opportunities for public involvement, and answer questions the public might have on the proposal. Public notification and details of the scoping meetings will be published in the Federal Register and local papers in advance.

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Sincerely

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SCOTT A. VANDER HAMM, COLONEL, USAF

Attachments:  
Map  
Scoping Locations

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 12 2008

Ms. Kathleen Burrage  
Crow Nation Office of Legal Counsel  
Batcheeitche Avenue  
PO Box 340  
Crow Agency MT 59022

Dear Ms. Burrage

The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.

The proposed action would restructure and reconfigure the existing Powder River Military Operations Areas (MOAs) and associated Air Traffic Control Assigned Airspaces (ATCAAs). The PRTC proposal would establish two air refueling routes, create additional low altitude MOA (500 feet Above Ground Level [AGL] up to, but not including, 18,000 feet above Mean Sea Level [MSL]) and high-altitude ATCAA (18,000-60,000 MSL) combinations in portions of South Dakota, North Dakota, Wyoming and Montana. The proposal would support additional ground-based assets to simulate threats and an increase in aircraft training flights, permit the use of training chaff and flares, and authorize supersonic flight above 10,000 AGL. Three action alternatives and a no-action alternative have currently been identified for analyses and are discussed in the attached meeting brochure (Atch 1).

As part of this Environmental Impact Analysis Process, and in continuance of Government-to-Government consultation initiated by Colonel Scott Vander Hamm, 28 BW/CC, Ellsworth AFB SD, we request your assistance in gathering information concerning previous archaeological and historic studies for the areas under the affected region. We would appreciate any assistance you could provide in identifying and retrieving this important information, as well as concerns you may have about the potential effects of the proposal on significant cultural resources. All or portions of the following locations have the potential of being affected by the proposal's overhead training airspace due to one or more of the alternatives: **Montana**—Crow and Northern Cheyenne Reservations and the counties of Big Horn, Carter, Custer, Fallon, Powder River, Rosebud, Treasure, and Yellowstone; **North Dakota**—Standing Rock Reservation and Adams, Billings, Bowman, Golden Valley, Grant, Hettinger, Morton, Sioux, Slope, and Stark counties; **South Dakota**—Standing Rock and Cheyenne River Reservations, and Butte, Corson, Harding, Lawrence, Meade, Pennington, Perkins, Ziebach counties; and **Wyoming**: Campbell, Crook, Sheridan, and Weston counties.


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The Air Force is committed to community outreach and we appreciate the opportunity to hold a community meeting at the Apsaalooke Center in Crow Agency on Monday, June 23, 2008 from 9:30 – 11:30 a.m. Open communication of issues is a critical element of the EIS process, and we would appreciate your assistance in posting the attached meeting flyer (Atch 2) around the community and encouraging public participation. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the NHPA with public involvement in the EIS prepared under the Environmental Impact Analysis Process. Meetings with public, agency, and Native American stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues to be considered in the environmental impact analysis process.

To ensure the Air Force has sufficient time to consider your input in the preparation of the Draft EIS, please provide information and/or comments to Ms. Linda DeVine, HQ ACC/A7PP, 129 Andrews Street, Room 317, Langley AFB VA 23665-2769, not later than August 4, 2008. If you have any specific questions about this request, please feel free to contact Ms. Linda DeVine at (757) 764-9434, or by electronic-mail at [acc.prtc@langley.af.mil](mailto:acc.prtc@langley.af.mil). You may also obtain information including the two attachments to this letter, from our website at [www.acclanning.org](http://www.acclanning.org). Thank you in advance for your assistance in this matter.

Sincerely,

  
BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

Attachment:

1. Scoping Meeting Brochure
2. Flyer

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November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 12 2008

Ms. Clara Caufield  
Northern Cheyenne Tribal Administration Offices  
600 S. Cheyenne Ave.  
Lame Deer, MT 59043

Dear Ms. Caufield,

The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.

The proposed action would restructure and reconfigure the existing Powder River Military Operations Areas (MOAs) and associated Air Traffic Control Assigned Airspaces (ATCAAs). The PRTC proposal would establish two air refueling routes, create additional low altitude MOA (500 feet Above Ground Level [AGL] up to, but not including, 18,000 feet above Mean Sea Level [MSL]) and high-altitude ATCAA (18,000-60,000 MSL) combinations in portions of South Dakota, North Dakota, Wyoming and Montana. The proposal would support additional ground-based assets to simulate threats and an increase in aircraft training flights, permit the use of training chaff and flares, and authorize supersonic flight above 10,000 AGL. Three action alternatives and a no-action alternative have currently been identified for analyses and are discussed in the attached meeting brochure (Atch 1).

As part of this Environmental Impact Analysis Process, and in continuance of Government-to-Government consultation initiated by Colonel Scott Vander Hamm, 28 BW/CC, Ellsworth AFB SD, we request your assistance in gathering information concerning previous archaeological and historic studies for the areas under the affected region. We would appreciate any assistance you could provide in identifying and retrieving this important information, as well as concerns you may have about the potential effects of the proposal on significant cultural resources. All or portions of the following locations have the potential of being affected by the proposal's overhead training airspace due to one or more of the alternatives: **Montana**—Crow and Northern Cheyenne Reservations and the counties of Big Horn, Carter, Custer, Fallon, Powder River, Rosebud, Treasure, and Yellowstone; **North Dakota**—Standing Rock Reservation and Adams, Billings, Bowman, Golden Valley, Grant, Hettinger, Morton, Sioux, Slope, and Stark counties; **South Dakota**—Standing Rock and Cheyenne River Reservations, and Butte, Corson, Harding, Lawrence, Meade, Pennington, Perkins, Ziebach counties; and **Wyoming**: Campbell, Crook, Sheridan, and Weston counties.


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November 2014**

The Air Force is committed to community outreach and we appreciate the opportunity to hold a community meeting at the Northern Cheyenne Tribal Administration Building Council Chambers on Tuesday, June 24, 2008 from 9:30 - 11:30 a.m. Open communication of issues is a critical element of the EIS process, and we would appreciate your assistance in posting the attached meeting flyers (Atch 2) around the community and encouraging public participation. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the NHPA with public involvement in the EIS prepared under the Environmental Impact Analysis Process. Meetings with public, agency, and Native American stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues to be considered in the environmental impact analysis process.

To ensure the Air Force has sufficient time to consider your input in the preparation of the Draft EIS, please provide information and/or comments to Ms. Linda DeVine, HQ ACC/A7PP, 129 Andrews Street, Rm 317, Langley AFB VA 23665-2769 not later than August 4, 2008. If you have any specific questions about this request, please feel free to contact Ms. Linda DeVine at (757) 764-9434, or by electronic-mail at [acc.prtc@langley.af.mil](mailto:acc.prtc@langley.af.mil). You may also obtain information including the two attachments to this letter, from our website at [www.acplanning.org](http://www.acplanning.org). Thank you in advance for your assistance in this matter.

Sincerely,

  
BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

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November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 12 2008

Mr. Donald Red Thunder  
Land Operations Office  
Building 2001  
Main Street  
Eagle Butte SD 57625

Dear Mr. Red Thunder,

The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.

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As part of this Environmental Impact Analysis Process, and in continuance of Government-to-Government consultation initiated by Colonel Scott Vander Hamm, 28 BW/CC, Ellsworth AFB SD, we request your assistance in gathering information concerning previous archaeological and historic studies for the areas under the affected region. We would appreciate any assistance you could provide in identifying and retrieving this important information, as well as concerns you may have about the potential effects of the proposal on significant cultural resources. All or portions of the following locations have the potential of being affected by the proposal's overhead training airspace due to one or more of the alternatives: **Montana**—Crow and Northern Cheyenne Reservations and the counties of Big Horn, Carter, Custer, Fallon, Powder River, Rosebud, Treasure, and Yellowstone; **North Dakota**—Standing Rock Reservation and Adams, Billings, Bowman, Golden Valley, Grant, Hettinger, Morton, Sioux, Slope, and Stark counties; **South Dakota**—Standing Rock and Cheyenne River Reservations, and Butte, Corson, Harding, Lawrence, Meade, Pennington, Perkins, Ziebach counties; and **Wyoming**: Campbell, Crook, Sheridan, and Weston counties.

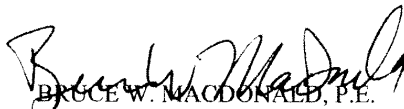
*Global Power For America*

**Final  
November 2014**

The Air Force is committed to community outreach and we appreciate the opportunity to hold a community meeting at the Multi-Purpose Building in Dupree on Wednesday, July 16, 2008 from 4:00 – 7:00 p.m. Open communication of issues is a critical element of the EIS process, and we would appreciate your assistance in posting the attached meeting flyers (Atch 2) around the community and encouraging public participation. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the NHPA with public involvement in the EIS prepared under the Environmental Impact Analysis Process. Meetings with public, agency, and Native American stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues to be considered in the environmental impact analysis process.

To ensure the Air Force has sufficient time to consider your input in the preparation of the Draft EIS, please provide information and/or comments to Ms. Linda DeVine, HQ ACC/A7PP, 129 Andrews Street, Room 317, Langley AFB VA 23665-2769 not later than August 4, 2008. If you have any specific questions about this request, please feel free to contact Ms. Linda DeVine at (757) 764-9434, or by electronic-mail at [acc.prtc@langley.af.mil](mailto:acc.prtc@langley.af.mil). You may also obtain information including the two attachments to this letter, from our website at [www.accplanning.org](http://www.accplanning.org). Thank you in advance for your assistance in this matter.

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BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

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November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 12 2008

Mr. Richard Bird  
Chairman, Economic Committee  
PO Box D  
Fort Yates ND 58538

Dear Mr. Bird,

The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.

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As part of this Environmental Impact Analysis Process, and in continuance of Government-to-Government consultation initiated by Colonel Scott Vander Hamm, 28 BW/CC, Ellsworth AFB SD, we request your assistance in gathering information concerning previous archaeological and historic studies for the areas under the affected region. We would appreciate any assistance you could provide in identifying and retrieving this important information, as well as concerns you may have about the potential effects of the proposal on significant cultural resources. All or portions of the following locations have the potential of being affected by the proposal's overhead training airspace due to one or more of the alternatives: **Montana**—Crow and Northern Cheyenne Reservations and the counties of Big Horn, Carter, Custer, Fallon, Powder River, Rosebud, Treasure, and Yellowstone; **North Dakota**—Standing Rock Reservation and Adams, Billings, Bowman, Golden Valley, Grant, Hettinger, Morton, Sioux, Slope, and Stark counties; **South Dakota**—Standing Rock and Cheyenne River Reservations, and Butte, Corson, Harding, Lawrence, Meade, Pennington, Perkins, Ziebach counties; and **Wyoming**: Campbell, Crook, Sheridan, and Weston counties.


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November 2014**

The Air Force is committed to community outreach and we appreciate the opportunity to hold a community meeting at the Bear Soldier District Gym in McLaughlin, SD on Friday, July 11, 2008 from 3:00 – 5:00 p.m. and at the Community Center in Fort Yates on Friday, July 11, 2008 from 6:00 – 8:00 p.m. Open communication of issues is a critical element of the EIS process, and we would appreciate your assistance in posting the attached meeting flyers (Atch 2) around the community and encouraging public participation. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the NHPA with public involvement in the EIS prepared under the Environmental Impact Analysis Process. Meetings with public, agency, and Native American stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues to be considered in the environmental impact analysis process.

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Sincerely,

  
BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

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November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 12 2008

Chairman Joseph Brings Plenty  
Cheyenne River Sioux Tribal Council  
PO Box 5690  
Eagle Butte SD 57625

Dear Mr. Brings Plenty,

The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.

The proposed action would restructure and reconfigure the existing Powder River Military Operations Areas (MOAs) and associated Air Traffic Control Assigned Airspaces (ATCAAs). The PRTC proposal would establish two air refueling routes, create additional low altitude MOA (500 feet Above Ground Level [AGL] up to, but not including, 18,000 feet above Mean Sea Level [MSL]) and high-altitude ATCAA (18,000-60,000 MSL) combinations in portions of South Dakota, North Dakota, Wyoming and Montana. The proposal would support additional ground-based assets to simulate threats and an increase in aircraft training flights, permit the use of training chaff and flares, and authorize supersonic flight above 10,000 AGL. Three action alternatives and a no-action alternative have currently been identified for analyses and are discussed in the attached meeting brochure (Atch 1).

As part of this Environmental Impact Analysis Process, and in continuance of Government-to-Government consultation initiated by Colonel Scott Vander Hamm, 28 BW/CC, Ellsworth AFB SD, we request your assistance in gathering information concerning previous archaeological and historic studies for the areas under the affected region. We would appreciate any assistance you could provide in identifying and retrieving this important information, as well as concerns you may have about the potential effects of the proposal on significant cultural resources. All or portions of the following locations have the potential of being affected by the proposal's overhead training airspace due to one or more of the alternatives: **Montana**—Crow and Northern Cheyenne Reservations and the counties of Big Horn, Carter, Custer, Fallon, Powder River, Rosebud, Treasure, and Yellowstone; **North Dakota**—Standing Rock Reservation and Adams, Billings, Bowman, Golden Valley, Grant, Hettinger, Morton, Sioux, Slope, and Stark counties; **South Dakota**—Standing Rock and Cheyenne River Reservations, and Butte, Corson, Harding, Lawrence, Meade, Pennington, Perkins, Ziebach counties; and **Wyoming**: Campbell, Crook, Sheridan, and Weston counties.

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November 2014**

The Air Force is committed to community outreach and we appreciate the opportunity to hold a community meeting at the Multi-Purpose Building in Dupree on Wednesday, July 16, 2008 from 4-7 p.m. Open communication of issues is a critical element of the EIS process, and we would appreciate your assistance in posting the attached meeting flyers (Atch 2) around the community and encouraging public participation. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the NHPA with public involvement in the EIS prepared under the Environmental Impact Analysis Process. Meetings with public, agency, and Native American stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues to be considered in the environmental impact analysis process.

To ensure the Air Force has sufficient time to consider your input in the preparation of the Draft EIS, please provide information and/or comments to Ms. Linda DeVine, HQ ACC/A7PP, 129 Andrews Street, Room 317, Langley AFB VA 23665-2769 not later than August 4, 2008. If you have any specific questions about this request, please feel free to contact Ms. Linda DeVine at (757) 764-9434, or by electronic-mail at [acc.prtc@langley.af.mil](mailto:acc.prtc@langley.af.mil). You may also obtain information including the two attachments to this letter, from our website at [www.acclanning.org](http://www.acclanning.org). Thank you in advance for your assistance in this matter.

Sincerely,

  
BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

Attachment:

1. Scoping Meeting Brochure
2. Flyer

*Global Power For America*



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*November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR Bureau of Indian Affairs  
Standing Rock Agency  
PO Box E  
Fort Yates, ND 58538

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)


1. The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.
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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR Bureau of Indian Affairs  
Cheyenne River Agency  
PO Box 325  
Eagle Butte, SD 57625

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR Bureau of Indian Affairs  
Pine Ridge Agency  
PO Box 1203  
Pine Ridge, SD 57770

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR Bureau of Indian Affairs  
Rocky Mt Regional Office  
316 N. 26th St.  
Billings, MT 59101

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR Bureau of Indian Affairs  
Midwest Regional Office  
One Federal Drive, Rm. 550  
Ft. Snelling, MN 55111-4007

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR Bureau of Indian Affairs  
Great Plains Regional Office  
115 4th Ave. SE  
Aberdeen, SD 57401

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

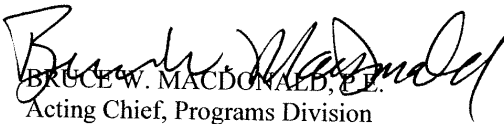
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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR South Dakota State Historical Society  
900 Governors Drive  
Pierre, SD 57501-2217

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

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3. The purpose of this correspondence is to initiate the Section 106 process of the National Historic Preservation Act (NHPA) of 1966 (as amended) in the potentially affected areas. We are in the early stages of gathering information concerning previous archaeological and historic studies for the areas under the affected region. We would appreciate any assistance you could provide in identifying and retrieving this important information, as well as concerns you may have about the potential effects of the proposal on significant cultural resources. All or portions of the following locations have the potential of being affected by the proposal's overhead training airspace due to one or more of the alternatives: **Montana**—Crow and Northern Cheyenne Reservations and the counties of Big Horn, Carter, Custer, Fallon, Powder River, Rosebud, Treasure, and Yellowstone; **North Dakota**—Standing Rock Reservation and Adams, Billings, Bowman, Golden Valley, Grant, Hettinger, Morton, Sioux, Slope, and Stark counties; **South Dakota**—Standing Rock and Cheyenne River Reservations, and Butte, Corson,


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*November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR State Historical Society of North Dakota  
612 East Boulevard Avenue  
Bismarck, ND 58505-0830

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

1. The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.
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Harding, Lawrence, Meade, Pennington, Perkins, Ziebach counties; and *Wyoming*: Campbell, Crook, Sheridan, and Weston counties.

4. The Air Force is committed to community outreach. Recognizing that open communication of issues is a critical element of the EIS process, the Air Force will host public meetings in communities underlying and/or adjacent to the proposed airspace as identified in the meeting flyer at attachment 2. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the NHPA with public involvement in the EIS prepared under the Environmental Impact Analysis Process. The 28 Bomb Wing Commander at Ellsworth AFB has initiated consultation with the tribal leaders of the Crow, Northern Cheyenne, Standing Rock and Cheyenne River Nations and community meetings are being coordinated on each Native American Reservation. Meetings with public, agency, and Native American stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues to be considered in the environmental impact analysis process.

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BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

Attachment:

1. Scoping Meeting Brochure
2. Flyer

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*November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR State Parks & Cultural Resources Historic Preservation Office  
2301 Central Avenue  
Cheyenne, WY 82002

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR Montana Historical Society  
225 N. Roberts  
PO Box 20121  
Helena, MT 59620

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

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DEPARTMENT OF THE AIR FORCE  
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LANGLEY AIR FORCE BASE, VIRGINIA

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MEMORANDUM FOR Wyoming State Parks/Historic Sites HQ  
2301 Central Avenue  
Cheyenne, WY 82002

FROM: HQ ACC/A7P  
129 Andrews Street  
Langley AFB VA 23665-2769

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

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Chippewa-Cree Business Committee  
Rocky Boy Route, Box 544  
Box Elder, MT 59521

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

Turtle Mountain Tribal Council  
PO Box 900  
Highway 5 West  
Belcourt, ND 58316

Dear Sir/Madam,

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DEPARTMENT OF THE AIR FORCE  
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Three Affiliated Tribes Business Council  
404 Frontage Road  
New Town, ND 58763

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

Eastern Shoshone Tribal Council  
15 North Fork Road  
PO Box 538  
Fort Washakie, WY 82514

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2. Flyer

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November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

Rosebud Sioux Tribe  
PO Box 430  
Rosebud, SD 57570

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

Arapaho Business Council  
PO Box 396  
Fort Washakie, WY 82514

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DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

Oglala Sioux Tribal Council  
PO Box 2070  
Pine Ridge, SD 57770

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Confederated Salish and Kootenai Tribe  
PO Box 278  
51383 Highway 93 North  
Pablo, MT 59855

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DEPARTMENT OF THE AIR FORCE  
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LANGLEY AIR FORCE BASE, VIRGINIA

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Fort Belknap Community Council  
RR1, Box 66  
Harlem, MT 59526

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DEPARTMENT OF THE AIR FORCE  
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LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

Fort Peck Tribal Executive Board  
PO Box 1027  
501 Medicine Bear Road  
Poplar, MT 59255

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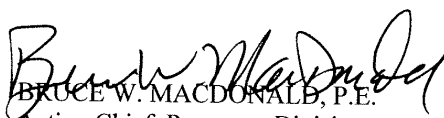
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DEPARTMENT OF THE AIR FORCE  
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Spirit Lake Sioux Tribal Council  
PO Box 359  
Fort Totten, ND 58335

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The Air Force is committed to community outreach. Recognizing that open communication of issues is a critical element of the EIS process, the Air Force will host public


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meetings in communities underlying and/or adjacent to the proposed airspace as identified in the meeting flyer at attachment 2. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the NHPA with public involvement in the EIS prepared under the Environmental Impact Analysis Process. Meetings with public, agency, and Native American stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues to be considered in the environmental impact analysis process.

To ensure the Air Force has sufficient time to consider your input in the preparation of the Draft EIS, please provide information and/or comments to Ms. Linda DeVine, HQ ACC/A7PP at the above address not later than August 4, 2008. If you have any specific questions about this proposal, please feel free to contact Ms. Linda DeVine at (757) 764-9434, or by electronic-mail at [acc.prtc@langley.af.mil](mailto:acc.prtc@langley.af.mil). You may also obtain information including the two attachments to this letter, from our website at [www.acclanning.org](http://www.acclanning.org). Thank you in advance for your assistance in this matter.

Sincerely,

  
BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

Attachment:

1. Scoping Meeting Brochure
2. Flyer

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*November 2014*



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

JUN 3 2008

MEMORANDUM FOR DISTRIBUTION

FROM: HQ ACC/A7P  
129 Andrews Street, Room 317  
Langley AFB VA 23665-2769

SUBJECT: Powder River Training Complex, Environmental Impact Statement (EIS)

1. The United States Air Force (Air Force) is in the process of preparing an EIS to assess the potential environmental consequences of a proposal to expand and enhance the existing Powder River Complex (PRC) near Ellsworth Air Force Base (AFB) SD. The proposal would create the Powder River Training Complex (PRTC). The PRTC would more effectively use limited resources and finite flying hours by providing locally the realistic training needed by B-1 and B-52 aircrews flying from Ellsworth AFB SD and Minot AFB ND, respectively. This airspace proposal addresses the training and other limitations affecting the existing PRC training assets as they are currently configured.
2. The proposed action would restructure and reconfigure the existing Powder River Military Operations Areas (MOAs) and associated Air Traffic Control Assigned Airspaces (ATCAAs). The PRTC proposal would establish two air refueling routes, create additional low altitude MOA (500 feet Above Ground Level [AGL] up to, but not including, 18,000 feet above Mean Sea Level [MSL]) and high-altitude ATCAA (18,000-60,000 MSL) combinations in portions of South Dakota, North Dakota, Wyoming and Montana. The proposal would support additional ground-based assets to simulate threats and an increase in aircraft training flights, permit the use of training chaff and flares, and authorize supersonic flight above 10,000 AGL. Three action alternatives and a no-action alternative have currently been identified for analyses and are discussed in the attached meeting brochure (Atch 1). All or portions of the following locations have the potential of being affected by the proposal's overhead training airspace due to one or more of the alternatives: **Montana**—Crow and Northern Cheyenne Reservations and the counties of Big Horn, Carter, Custer, Fallon, Powder River, Rosebud, Treasure, and Yellowstone; **North Dakota**—Standing Rock Reservation and Adams, Billings, Bowman, Golden Valley, Grant, Hettinger, Morton, Sioux, Slope, and Stark counties; **South Dakota**—Standing Rock and Cheyenne River Reservations, and Butte, Corson, Harding, Lawrence, Meade, Pennington, Perkins, Ziebach counties; and **Wyoming**: Campbell, Crook, Sheridan, and Weston counties.
3. Recognizing that open communication of issues is a critical element of the EIS process, the Air Force will host numerous public meetings in communities underlying and/or adjacent to the proposed action (Atch 2). The scoping meetings will be held in an open-house format, where Air Force representatives will describe the proposed action and alternatives, the National Environmental Policy Act process which we are undertaking, outline opportunities for public involvement, and answer questions on the proposal. The meetings will last from 4:00 to 7:00 pm

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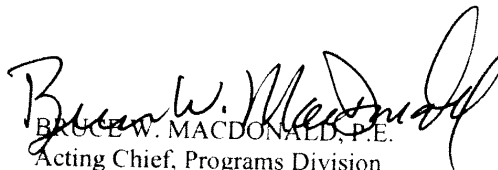
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at all locations, and interested parties or citizens are welcome to come at any time since information will be provided throughout the duration of the open house.

4. Meetings with public and agency stakeholders during this scoping process will help identify the full range of reasonable alternatives, potential impacts, and key issues throughout the environmental impact analysis process. The Air Force intends to coordinate public involvement for the purpose of Section 106 review under the National Historic Preservation with public involvement in the EIS prepared under this Environmental Impact Analysis Process. The Federal Aviation Administration has accepted the Air Force's request to be a cooperating agency for this action and has appointed the Central Service Area as their office of primary responsibility for this EIS.

5. The Air Force will accept comments at any time during the environmental process and any information you feel would assist us in this process would be appreciated. To ensure the Air Force has sufficient time to consider public input in the preparation of the draft EIS, information and comments should be submitted to Ms. Linda DeVine, HQ ACC/A7PP, 129 Andrews Street, Room 317, Langley AFB VA 23665-2769 by August 4, 2008.

6. If you have any specific questions about this proposal, please feel free to contact Ms. DeVine at (757) 764-9434, by electronic-mail at [acc.prtc@langley.af.mil](mailto:acc.prtc@langley.af.mil) or contact the public affairs office at Ellsworth AFB SD, 605-385-5056. You may also obtain information including the two attachments to this letter, from our website at [www.accplanning.org](http://www.accplanning.org). Thank you in advance for your assistance in this matter.

  
BRUCE W. MACDONALD, P.E.  
Acting Chief, Programs Division

Attachments:

1. Scoping Meeting Brochure
2. Flyer

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November 2014**

**DISTRIBUTION LIST**

Nadenicek Joe SD Dept. of Environmental and Natural Resources 523 E Capitol Avenue Pierre, SD 57501	Everts Tom Legislative Environmental Quality Council Room 171 State Capitol PO Box 201704 Helena, MT 59620	Karen Breslin National Park Service, Intermountain Region 12795 Alameda Pkwy Denver, CO 80225
James Boyd ND Division of Community Service PO Box 2057 600 E Boulevard Ave, Dept 105 Bismarck, ND 58502	Willie R. Taylor, PhD Office of Environmental Policy and Compliance U.S. Department of the Interior 1849 "C" Street NW, M/S 2342 Washington, DC 20240	Patty Rooney National Park Service, Midwest Region 601 Riverfront Drive Omaha, NE 68102
Vicki McCusker NPS Natural Sounds Program 1201 Oakridge Dr., Suite 100 Fort Collins, CO 80525	Vi Hillman Bureau of Land Management Newcastle Field Office 1101 Washington Blvd Newcastle, WY 82701-2968	Larry Svoboda US Environmental Protection Agency, Region 8 1595 Wynkoop Street Denver, CO 80202-1129
Chris Hanson Bureau of Land Management Buffalo Field Office 1425 Fort Street Buffalo, WY 82834	Lonny Bagley Bureau of Land Management North Dakota Field Office 99 23rd Avenue West, Suite A Dickinson, ND 58601	Elaine Raper Bureau of Land Management Miles City Field Office 111 Garryowen Road Miles City, MT 59301-0940
Stephen Potts U.S. Environmental Protection Agency, Region 8 - Montana Office 10 W 15th St, Ste. 3200 Helena, MT 59626	Gene Terland Bureau of Land Management 5001 Southgate Drive Billings, MT 59101	Don Simpson Bureau of Land Management 5353 Yellowstone Cheyenne, WY 82009
Barry Cooper Federal Aviation Administration Great Lakes Region 2300 East Devon Avenue Des Plaines, IL 60018	Ron de Yong Montana Department of Agriculture 303 N Roberts Street Helena, MT 59620	Tom Tidwell USDA Forest Service Northern Region One PO Box 7669 Missoula, MT 59807
Dennis Roberts Federal Aviation Administration Northwest Mountain Region 1601 Lind Avenue Southwest Renton, WA 98057	Marian Atkins Bureau of Land Management South Dakota Field Office 310 Roundup Street Belle Fourche, SD 57717-1698	Richard Opper MT DEQ 1520 E Sixth Avenue PO Box 200901 Helena, MT 59620-0901
Mary Sexton Department of Natural Resources and Conservation 1625 Eleventh Avenue Helena, MT 59620	Mark Baumler Montana Historical Society 225 N. Roberts PO Box 20121 Helena, MT 59620	Jeff Hagener Montana Fish, Wildlife, and Parks 1420 E 6th Avenue PO Box 200701 Helena, MT 59620
Gary Preszler North Dakota State Land Dept. 1707 North 9th Street PO Box 5523 Bismarck, ND 58506-5523	Cheryl Kulas ND Indian Affairs Commission 600 East Boulevard Avenue 1st Floor - Judicial Wing Bismarck, ND 58505-0300	John Hoeven North Dakota Governor's Office 600 East Boulevard Avenue Bismarck, ND 58505-0001

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Roger Johnson  
North Dakota Department of Agriculture  
600 E Boulevard Ave Dept 602  
Bismarck, ND 58505-0020

Steven Pirner, P.E.  
SD DENR  
PMB 2020  
Joe Foss Building  
523 E Capitol  
Pierre, SD 57501

Steven Doohen  
South Dakota Department of Military &  
Veterans Affairs  
Soldiers & Sailors Memorial Building  
425 East Capitol Avenue  
Pierre, SD 57501-5070

Mary Hopkins  
State Parks & Cultural Resources  
Historic Preservation Office  
2301 Central Avenue  
Cheyenne, WY 82002

Karl Altenburg  
North Dakota Wing Civil Air Patrol  
PO Box 608  
Bismarck, ND 58502-0608

John Etchepare  
Wyoming Department of Agriculture  
2219 Carey Avenue  
Cheyenne, WY 82002-0100

Joe Moore  
Wyoming Office of Homeland Security  
122 West 25th Street  
Herschler Bldg, 1st Floor East  
Cheyenne, WY 82002

Mike Rounds  
State of South Dakota  
Office of the Governor  
500 E Capitol Avenue  
Pierre, SD 57501

Larry Kotchman  
North Dakota Forest Service  
Molberg Center  
307 First Street East  
Bottineu, ND 58318

David Freudenthal  
State of Wyoming  
State Capitol, 200 West 24th Street  
Cheyenne, WY 82002-0010

Jeff Vonk  
South Dakota Game, Fish and Parks  
523 East Capitol Avenue  
Pierre, SD 57501

Tom Dravland  
South Dakota Department of Public  
Safety  
118 West Capitol Avenue  
Pierre, SD 57501

Douglass Prchal  
North Dakota Parks and Recreation  
Department  
1600 East Century Avenue, Suite 3  
Bismarck, ND 58503-0649

Bruce Lindholm  
South Dakota DOT  
Office of Aeronautics  
700 E Broadway Avenue  
Pierre, SD 57501-2586

John Cox  
WYDOT Headquarters  
5300 Bishop Blvd  
Cheyenne, WY 82009-3340

John Corra  
Department of Environmental Quality  
122 West 25th Street  
Herschler Building, 4th Floor West  
Cheyenne, WY 82002

Terry Cleveland  
Wyoming Game and Fish  
5400 Bishop Boulevard  
Cheyenne, WY 82006

William Even  
South Dakota Department of Agriculture  
523 E Capitol Avenue  
Pierre, SD 57501-3182

Mike Kintigh  
South Dakota Game, Fish and Parks  
3305 W South Street  
Rapid City, SD 57702

Roger Campbell  
South Dakota Office of Tribal  
Government Relations  
Capitol Lake Plaza  
711 East Wells Avenue  
Pierre, SD 57501-3369

Paul Schadewald  
North Dakota Game and Fish  
Department  
100 North Bismarck Expressway  
Bismarck, ND 58501-5095

Richard Benda  
Department of Tourism and State  
Development  
711 E Wells Avenue  
Pierre, SD 57501-3369

Barry Bowersox  
WYDOT  
District 4  
3540 Warlow Drive  
Gillette, WY 82716

Tanner Shatto  
Department of Environmental Quality,  
Sheridan Field Office  
1866 S Sheridan Avenue  
Sheridan, WY 82801

Jim Boyd  
North Dakota Department of Commerce  
1600 E Century Avenue, Ste. 2  
PO Box 2057  
Bismarck, ND 58502-2057

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Department of Tourism and State Development

July 7, 2008

Ms. Linda DeVine  
HQ ACC/A7PP  
129 Andrews Street, Room 317  
Langley AFB, VA 23665-2769

Project: 080604006F – Power River Training Complex, Environmental Impact Statement  
Location: Multiple Counties  
(DOD/Air Force)

Dear Ms. DeVine:

Thank you for the opportunity to comment on the above referenced project. The South Dakota Office of the State Historic Preservation Officer (SHPO) would like to provide the following list of areas in South Dakota that may be considered Traditional Cultural Properties and/or places of religious and cultural significance to Indian Tribes. The list also includes contact information for each land managing agency associated with the resource.

Bear Butte National Historic Landmark: Bear Butte State Park  
PO Box 688; E Hwy 79  
Sturgis, SD 57785

National Park Service: Ernest Quintana, Regional Director  
National Park Service, MWRO  
601 River Front Drive  
Omaha, NE 68102

Black Hills: District Ranger  
Black Hills National Forest  
Northern Hills Ranger District  
2014 N. Main Street  
Spearfish, SD 57783

Custer National Forest: Forest Supervisor  
Custer National Forest  
1310 Main Street  
Billings, MT 59105

Office of Tourism  
Governor's Office of Economic  
Development

Tribal Government Relations  
711 E Wells Ave / Pierre, SD 57501-3369  
Phone: 605-773-3301 / Fax: 605-773-3256  
travelsd.com / sdgreatprofits.com /  
sdtribalrelations.com

South Dakota Arts Council

800 Governors Dr. / Pierre, SD 57501-2294  
Phone: 605-773-3131 or 1-800-423-6665 in SD  
Fax: 605-773-6962  
sdac@state.sd.us / sdarts.org

**South Dakota State  
Historical Society**

900 Governors Dr. / Pierre, SD 57501-2217  
Phone: 605-773-3458 / Fax: 605-773-6041  
sdhistory.org

South Dakota Housing  
Development Authority

PO Box 1237 / Pierre, SD 57501-1237  
Phone: 605-773-3181 / Fax: 605-773-5154  
sdhda.org



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Please note the above list is not all inclusive. For additional information concerning the identification of historic properties, we recommend contacting the appropriate consulting parties as outlined in 36 CFR part 800 – Protection of historic properties. For your convenience a list of Indian Tribes and contact information has been included.

Should you require additional information, please contact Paige Hoskinson Olson, Review and Compliance Coordinator, at (605) 773-6004. Your concern for the non-renewable cultural heritage of our state is appreciated.

Sincerely,

Jay D. Vogt  
State Historic Preservation Officer



Paige Hoskinson Olson  
Review and Compliance Coordinator

Enclosure: South Dakota Tribal Chairman and Tribal Historic Preservation Offices

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South Dakota Tribal Chairman and Tribal Historic Preservation Offices

**Chairman:** Joseph Brings Plenty  
Cheyenne River Sioux Tribe  
PO Box 590  
Eagle Butte, SD 57625-0590  
Phone (605) 964-4155  
Fax (605) 964-4151

**THPO:**  
Cheyenne River Sioux Tribe  
Tribal Historic Preservation Office  
PO Box 590  
Eagle Butte, SD 57625  
Phone (605) 964-7554  
Fax (605) 964-7552

**Chairman:** Brandon Sazue Sr.  
Crow Creek Sioux Tribe  
PO Box 50  
Ft. Thompson, SD 57339-0050  
Phone (605) 245-2221  
Fax (605) 245-2470

**Chairman:** Josh Weston  
Flandreau-Santee Sioux Tribe  
PO Box 283  
Flandreau, SD 57028-0283  
Phone (605) 997-3512  
Fax (605) 997-3878

**Chairman:** Michael Jandreau  
Lower Brule Sioux Tribe  
PO Box 187  
Lower Brule, SD 57548-0187  
Phone (605) 473-5561  
Fax (605) 473-5606

**Cultural Resources:** Scott Jones  
Lower Brule Sioux Tribe  
PO Box 187  
Lower Brule, SD 57548-0187  
Phone (605) 473-5561  
Fax (605) 473-5606

**Chairman:** John Yellow Bird Steele  
Oglala Sioux Tribe  
PO Box 2070  
Pine Ridge, SD 57770-2070  
Phone (605) 867-5821  
Fax (605) 867-1449

**Cultural Resources:** Joyce Whiting  
Oglala Sioux Tribe  
US Highway 18  
Behind Tribal Building  
Pine Ridge, SD 57770  
(605) 867-1271

**Chairman:** Rodney Bordeaux  
Rosebud Sioux Tribe  
PO Box 430  
Rosebud, SD 57570-0430  
Phone (605) 747-2381  
Fax (605) 747-2243

**THPO:** Russell Eagle Bear  
Rosebud Sioux Tribe  
Tribal Historic Preservation Office  
PO Box 658  
Rosebud, SD 57570-0658  
Phone (605) 747-2381  
Fax (605) 747-4227  
Kathy Arcoren  
Phone (605) 747-4255  
[rstthpo@yahoo.com](mailto:rstthpo@yahoo.com)

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**Chairman:** Mike Selvage  
Sisseton-Wahpeton Oyate  
PO Box 509  
Agency Village, SD 57262-0509  
Phone (605) 698-3911  
Fax (605) 698-3708

**Chairman:** Ron His Horse Is Thunder  
Standing Rock Sioux Tribe  
PO Box D  
Ft. Yates, ND 58538-0522  
Phone (701) 854-8500  
Fax (701) 854-7299

**Chairman:** Robert Cournoyer  
Yankton Sioux Tribe  
PO Box 248  
Marty, SD 57361-0248  
Phone (605) 384-3641  
Fax (605) 384-5687

**Chairman:** Marcus D. Wells, Jr.  
Mandan, Hidatsa & Arikara Nation  
Three Affiliated Tribes  
404 Frontage Road  
New Town, ND 58763  
Phone: (701) 627-4781  
Fax (701) 627-4748

**THPO:** Dianne Desrosiers  
Sisseton-Wahpeton Oyate  
PO Box 907  
Sisseton, SD 57262  
Phone (605) 698-4972  
Fax (605) 698-7054

**THPO:** Tim Mentz, Sr.  
Standing Rock Sioux Tribe  
Tribal Historic Preservation Office  
PO Box D  
Fort Yates, ND 58538  
Phone (701) 854-2120  
Fax (701) 854-2138

**THPO:**  
Mandan, Hidatsa & Arikara Nation  
Three Affiliated Tribes  
404 Frontage Road  
New Town, ND 58763  
Phone: (701) 627-4781  
Fax (701) 627-4748

**THPO:** Brady Grant  
Turtle Mountain Band of Chippewa  
PO Box 900  
Belcourt, North Dakota 58316  
(701) 477-2604

**THPO:** Pam Halverson  
Lower Sioux Indian Community  
PO Box 308  
39527 Res Hwy 1  
Morton MN 56270  
(507)697-6185

**THPO:** Curley Youpee  
Fort Peck  
PO Box 836  
Poplar MT 59255  
(406) 768-5155

**THPO:** Joanne White  
Northern Arapaho Tribe  
533 Ethete Rd  
Ethete, WY 82520

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November 2014*

07/29/2008 13 40 FAX 14064776491

NCTHPO

002/002



## NORTHERN CHEYENNE TRIBE

### ADMINISTRATION

P.O. BOX 128  
LAME DEER, MONTANA 59043  
(406) 477-6284  
FAX (406) 477-6210



July 28, 2008

Linda DeVine, PRTC EIS Manager  
129 Andrews St., Ste 102  
Langley AFB, VA 23665-2769

Dear Ms. DeVine;

The Northern Cheyenne Tribe appreciates your efforts in assuring that all parties are included in the scoping process. We are currently conducting an internal analysis from tribal programs and departments for comments and concerns regarding the Powder River Training Complex (PRTC) and the long term effects on the Northern Cheyenne reservation.


We would like to set up a meeting during the month of August as part of the government to government consultation process with Indian tribes. Specifically, the Northern Cheyenne Tribe would like to meet with the United States Air Force and discuss the effects of the PRTC management plan within the Northern Cheyenne reservation and ancestral lands within the PRTC.

A tentative date during the week of the 11<sup>th</sup> of August has been suggested. If this date is suitable please let our office know so that we can schedule a meeting with the Northern Cheyenne Tribal Council.

We would also like to request that the comments gathered will be forwarded to your office two (2) weeks after the suggested meeting has occurred.

If you have any questions, please let my office know.

Sincerely,

  
Geri Small, President  
Northern Cheyenne Tribe

LITTLE WOLF AND MORNING STAR - Out of defeat and exile they led us back to Montana and won our Cheyenne homeland that we will keep forever.

605-385-4407

**Final  
November 2014**



## United States Department of the Interior

National Park Service

Midwest Region  
601 Riverfront Drive  
Omaha, Nebraska 68102-4226



U. 7 AUG 2008  
ER-08/0406(MWR-PCL/PC)

Ms. Linda DeVine  
HQ ACC/A7PP  
129 Andrews Street, Suite 317  
Langley Air Force Base, Virginia 23665-2769

Dear Ms. DeVine:

The Department of the Interior (Department) has asked the National Park Service (NPS) to review and comment on the Notice of Intent to prepare an Environmental Impact Statement (EIS) for the Powder River Complex expansion located near Ellsworth Air Force Base, South Dakota. We offer the following comments for your consideration:

The proposed Powder River Complex expansion affects the northeast part of Wyoming, the southeast part of Montana, the southwest part of North Dakota, and the northwest part of South Dakota. National parks in the area include Theodore Roosevelt National Park, Mount Rushmore National Memorial, Devils Tower National Monument, Bighorn Canyon National Recreation Area, and Little Bighorn Battlefield, which are located within or very near the expansion area. The NPS is concerned about the potential of the proposed action to adversely affect the soundscapes of these parks.

The NPS evaluates Federal actions which may impact the human and natural environment within our parks with respect to our Organic Act mandates, including:

... to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations.

We are different from other Federal land management agencies in that, in addition to our national legislative mandates, each individual park is established under separate legislative authority which identifies specific purposes for the park and often includes the identification of key natural or cultural resources which define the integrity of the park.

Natural and cultural sounds are integral components of the suite of resources and values which NPS managers are charged with preserving and restoring. A soundscape refers to the total acoustic environment of an area. The soundscape (like air, water, scenery, or wildlife) of a national park is a valuable resource that can easily be degraded or destroyed by inappropriate sound levels and frequencies. An area's ability to transmit ecologically significant sounds is a function of the amount of extraneous noise intrusion.

We understand, at this stage in the process, the U.S. Air Force (USAF) would not include information in the Notice of Intent regarding how the environmental impact analysis would be





conducted. However, we are aware the USAF typically uses the day-night average sound level (DNL) metric in their environmental impact assessments. The DNL is an energy-based noise-averaging metric widely used by the Federal Aviation Administration (FAA) and the Department of Defense as the primary means for determining the cumulative noise energy exposure of individuals to noise resulting from aviation activities. Therefore, thresholds of significance that have been established by the FAA are based on community response. The FAA Order 1050.1E notes that special consideration needs to be given to the evaluation of the significance of noise impacts on noise sensitive areas within national parks. Since assumptions regarding the DNL levels are community-based in relation to airports, this metric is not adequate to assess impacts of noise to park resources, values, and visitor experience.

The NPS mission to conserve unimpaired park resources and values is a different standard than significance as defined by the FAA and other agencies. In recognition of the agencies' differences in mission and acknowledgement that special consideration needs to be given to the evaluation of noise impacts on noise-sensitive areas, it is imperative to provide information in the EIS for the NPS to be able to characterize the noise impacts from the proposed action and alternatives. Only then can Park Managers make decisions about impacts to park resources, values, and visitor experience. The NPS uses audibility-based, or "time above," metrics in order to express the time the sound level is above ambient. This takes into account the duration of aircraft noise events, the number of aircraft noise events, and the absolute sound level of events. "Time above" metrics correlate better with flight operations than the DNL metrics which obscure the dynamic range of acoustic events ([www.fican.org/pdf/HanscomNoise.pdf](http://www.fican.org/pdf/HanscomNoise.pdf)). These supplemental metrics would also better satisfy the requirements under the National Environmental Policy Act (NEPA) to characterize impacts to the environment in terms of intensity, context, and duration (40 CFR 1508.27). The NPS Natural Sounds Program would be happy to discuss the inclusion of supplemental metrics in the EIS with the USAF.

We are concerned that the proposed expansion of existing military operations airspace would allow flights down to 500 feet above ground level as well as permitting supersonic flights within the proposed Powder River Complex expansion. The NPS would prefer no supersonic or low-level flights over park units. For example, the NPS worked with the FAA to establish a No-Fly Advisory Zone for the Devils Tower National Monument. The existing No-Fly Zone Advisory Bulletin between the Billings Area FAA and the Devils Tower National Monument is enclosed for your reference. Alternative B would appear to support our desire for no low-level flights over park units. We are also concerned about the use of chaff and flares in and near park units.

We seek mutually beneficial solutions related to impacts associated with the proposed project – solutions that articulate how natural and cultural values interrelate in healthy ecosystems/cultural landscapes, and how public enjoyment of these places as well as the need to ensure realistic training needed by the USAF can be part of a strategy for ensuring the resources are protected unimpaired for future generations. The NPS has worked with the USAF through the Regional Airspace/Range Council meetings regarding military overflight issues, and has found the USAF to be very receptive to the NPS concerns and willing to find mutually acceptable solutions. We have

every confidence that this proactive interagency relationship will continue throughout the NEPA process and we look forward to working with the USAF regarding the NPS concerns about the proposed Power River Complex expansion.

The Department has a continuing interest in working with the USAF to ensure impacts to resources of concern to the Department are adequately addressed. For matters related to these comments, please contact Regional Environmental Coordinator Nick Chevance, National Park Service, Midwest Regional Office, 601 Riverfront Drive, Omaha, Nebraska 68102-4226, telephone: 402-661-1844.

We appreciate the opportunity to provide these comments.

Sincerely,



Ernest Quintana  
Regional Director

Enclosure



## Devils Tower

National Park Service  
U.S. Department of Interior  
Devils Tower National Monument

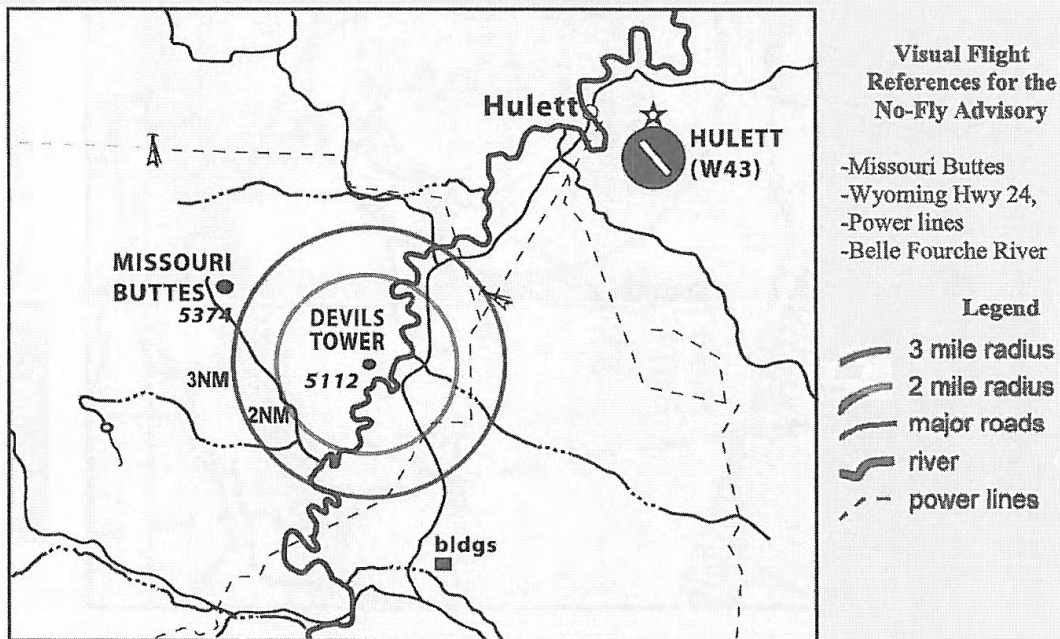


### No-Fly Advisory Zone

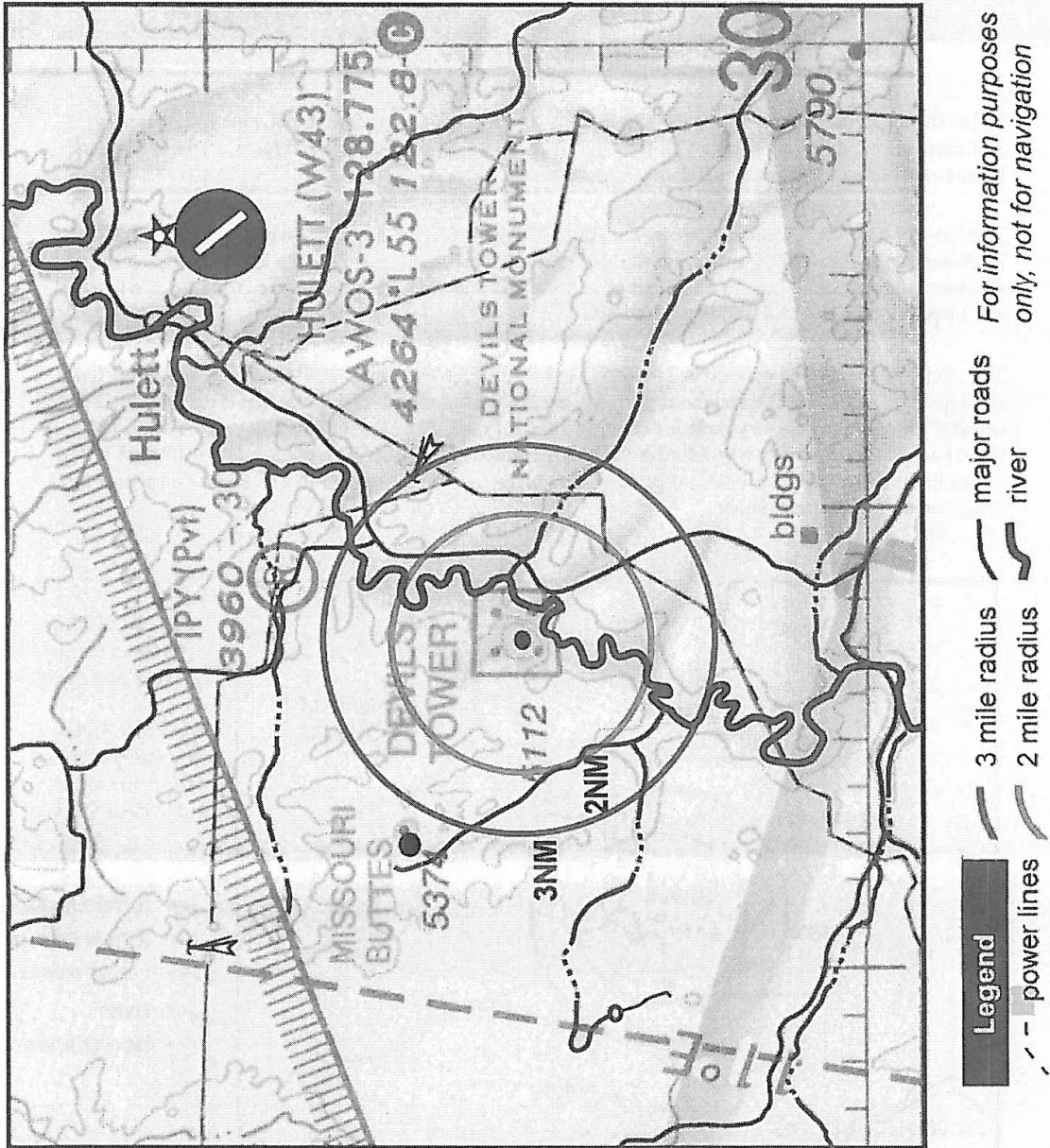
When the airport at Hulett, Wyoming (W43) was established, an agreement between the Federal Aviation Administration, Town of Hulett, Hulett Airport Advisory Board and Devils Tower National Monument created a "No-Fly Advisory Zone".

The No-Fly Advisory Zone recognizes the cultural significance of Devils Tower as a sacred site to over 20 American Indian Tribes, as well as the monument's purpose to preserve the lofty and isolated rock and surrounding public land as an object of historic and scientific interest for the enjoyment, education and inspiration of this and future generations.

The advisory is centered on Devils Tower, (Lat: 44°35'25.86"N, Long: 104°42'54.57"W) and extends for 2 nautical miles (NM) throughout the year, except for the month of June, when it extends for 3 nautical miles. The advisory includes no overflights of the Tower throughout the year. The Hulett (W43) airport is approximately 7.5 nautical miles northeast of Devils Tower. Pilots are advised to fly routes in northeasterly or southeasterly directions when using the airport for arrivals or departures to avoid the no-fly advisory zone.



For information purposes only, not for navigation



For information purposes  
only, not for navigation

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November 2014***

**From:** Morgenstern, John E Civ USAF ACC 28 CES/CEANN [John.Morgenstern@ellsworth.af.mil]  
**Sent:** Monday, December 01, 2008 1:53 PM  
**To:** Nancy Brown  
**Cc:** Green, Paul R ACC Civ USAF ACC ACC/A7AN; Rudolph, Teresa P; DeVine, Linda A ACC Civ USAF ACC ACC/A7PP; Jensen, Melody A Civ USAF ACC 28 CES/CEAON; Bodine, Douglas P Maj USAF ACC 28 OSS/ADO  
**Subject:** Invitation ot Participate in Sec 106 Consultaion

Nancy,

The Air Force, and more specifically Air Combat Command (ACC) and Ellsworth AFB, proposes to expand its current Powder River Training Complex (PRTC) from a fly-over area of approximately 14,800 square miles to as much as 37,800 square miles. A Notice of Intent to prepare an Environmental Impact Statement for this proposal was published in the Federal Register on 29 May 2008.

The proposed expansion of the PRTC has the potential to directly impact four states (North Dakota, South Dakota, Montana, and Wyoming) and four Indian Reservations (the Cheyenne River in South Dakota, the Standing Rock in North and South Dakota, and the Northern Cheyenne and Crow in Montana). Other tribes not a part of these reservations may also attach religious and/or cultural significance to the areas affected and thus become consulting parties in the Section 106 process.

During June and July 2008, public scoping meetings were held at numerous locations affected by the proposed range expansion both on and off the reservations. Many written public comments were received that will be considered and addressed in the EIS.

Colonel Vander Hamm, Commander, 28th Bomb Wing, Ellsworth AFB, SD, has met on a government-to-government basis with leaders of the four primary tribes to explain the proposal and how they and their reservations may have the potential to be affected by training missions. These meetings were held prior to the public scoping meetings.

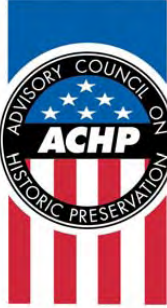
Pursuant to CFR 36 Part 800, I would like to take this opportunity to invite the ACHP to participate in further Section 106 consultation along with the appropriate SHPOs and/or THPOs affected by or having an interest in the PRTC expansion proposal. Thank you for your consideration and I look forward to your reply.

Sincerely,

*John Morgenstern*

John Morgenstern  
Natural/Cultural Resources Manager  
28 CES/CEVP  
Ellsworth AFB SD 57706  
(605) 385-2690, DSN: 675-  
[john.morgenstern@us.af.mil](mailto:john.morgenstern@us.af.mil)

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November 2014**



*Preserving America's Heritage*

December 3, 2008

Mr. John Morgenstern  
Natural/Cultural Resources Manager  
Department of the Air Force  
28 CES/CEVP  
Ellsworth AFB, SD 57706

**REF: *Proposed Expansion of the Powder River Training Complex***

Dear Mr. Morgenstern:

On December 1, 2008, the Advisory Council on Historic Preservation (ACHP) received your notification for the referenced project which was submitted in accordance with Section 800.6(a)(1) of our regulations, "Protection of Historic Properties" (36 CFR Part 800). Unfortunately, the background documentation included with your submission does not meet the specifications listed in Section 800.11(e). We, therefore, are unable to determine whether Appendix A of the regulations, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, applies to this undertaking. Accordingly, we request that you submit the following information so that we can determine whether our participation is warranted:

- A description of the undertaking, including photographs, maps, drawings, as necessary;
- A description of the steps to identify historic properties;
- A description of the affected historic properties;
- A description of the undertaking's effect on historic properties;
- An explanation of why the criteria of adverse effect were found applicable or inapplicable; and
- Copies or summaries of any views provided by consulting parties and the public, including comments from the Tribal Historic Preservation Officers, Indian tribes, and the appropriate State Historic Preservation Officers (SHPOs)

Upon receipt of the additional information, we will notify you within 15-days of our decision. Should you have any questions, feel free to contact Nancy Brown at 202-606-8582, or via email at [nbrown@achp.gov](mailto:nbrown@achp.gov).

Sincerely,

*Raymond V. Wallace*

Raymond V. Wallace  
Historic Preservation Technician  
Federal Property Management Section  
Office of Federal Agency Programs

ADVISORY COUNCIL ON HISTORIC PRESERVATION  
1100 Pennsylvania Avenue NW, Suite 803 Washington, DC 20004  
Phone: 202-606-8503 □ Fax: 202-606-8647 □ [achp@achp.gov](mailto:achp@achp.gov) □ [www.achp.gov](http://www.achp.gov)

***Final  
November 2014***

**From:** Morgenstern, John E Civ USAF ACC 28 CES/CEANN [John.Morgenstern@ellsworth.af.mil]  
**Sent:** Wednesday, February 04, 2009 9:53 AM  
**To:** Nancy Brown  
**Cc:** Rudolph, Teresa P  
**Subject:** Proposed Expansion of the Powder River Training Complex

Nancy,

I am writing to let you know I (we) have not forgotten or overlooked the ACHP letter dated December 3, 2008, (*REF: Proposed Expansion of the Powder River Training Complex*) requesting additional information/background documentation per 36 CRF Part 800, Section 800.11 (e). Most of the additional background documentation has been compiled; however, some significant details of the proposed undertaking are still being developed and coordinated between the Air Force and the FAA.

When details have been finalized, a description of the proposed undertaking along with the other background documentation will be forwarded to your office as requested.

Please feel free to contact me if you have questions or concerns.

Sincerely,

*John Morgenstern*

John Morgenstern  
Natural/Cultural Resources Manager  
28 CES/CEVP  
Ellsworth AFB SD 57706  
(605) 385-2690, DSN: 675-  
[john.morgenstern@us.af.mil](mailto:john.morgenstern@us.af.mil)

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November 2014*



**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

**AUG 05 2009**

Colonel Jeffrey B. Taliaferro  
Commander, 28th Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Mr. Leroy Spang, President  
Northern Cheyenne Council  
PO Box 128  
Lame Deer MT 59043

Dear President Spang

Having recently assumed command of the 28th Bomb Wing, I am writing to introduce myself prior to the scheduled government-to-government consultation with the Northern Cheyenne Tribal Council on August 17.

I believe meeting will help us both better understand our unique perspectives and continue the meaningful dialogue initiated by Colonel Vander Hamm between the Northern Cheyenne Tribe and Team Ellsworth. Our discussions must be open and honest, respecting each other's cultures, and trusting of each other's desire to maintain a healthy relationship. My goal for this consultation is to get to know you and other members of the tribal council, and to help me better understand and address the concerns identified in President Small's letter to the Air Force on September 8, 2008 in response to the scoping process for the proposed Powder River Training Complex (PRTC). If you have other specific issues you'd like to discuss, please feel free to contact me prior to the scheduled meeting so I can arrive more prepared, and we can make the meeting more productive.

We also welcome you and other members of the tribal council to visit Ellsworth Air Force Base as it would give us an opportunity to familiarize you with our base and the B-1 bomber. I look forward to meeting you and learning more about the people of the Northern Cheyenne Tribe.

Please contact me at (605) 385-2801 if you have any questions. If it's helpful, please feel free to have someone contact Mr. John Morgenstern, my natural and cultural resources manager, at (605) 385-2690.

Sincerely

A handwritten signature in black ink, appearing to read "J. Taliaferro".

JEFFREY B. TALIAFERRO, Colonel, USAF

Attachment:  
Official Biography

*Final  
November 2014*



**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

**AUG 05 2009**

Colonel Jeffrey B. Taliaferro  
Commander, 28th Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Joseph Brings Plenty, Chairman  
Cheyenne River Sioux Tribe  
PO Box 590  
Eagle Butte SD 57625

Dear Chairman Brings Plenty

Having recently assumed command of the 28th Bomb Wing, I am writing to introduce myself and respectfully request a meeting to continue the government-to-government relationship and meaningful dialogue between the Cheyenne River Sioux Tribe and Team Ellsworth.

I believe meeting will help us both better understand our unique perspectives and continue the meaningful dialogue initiated by Colonel Vander Hamm between the Cheyenne River Sioux Tribe and Team Ellsworth. Our discussions must be open and honest, respecting each other's cultures, and trusting of each other's desire to maintain a healthy relationship. My goal for this consultation is to get to know you and other members of the tribal council. If you have other specific issues you'd like to discuss when we meet, please feel free to contact me prior to the scheduled meeting so I can arrive more prepared, and we can make the meeting more productive.

We would be honored to host you and other members of the tribal council again to visit Ellsworth Air Force Base as it would give us an opportunity to provide you with a base tour. If you'd prefer to meet on the reservation or elsewhere, please let me know the dates you are available. I look forward to meeting you and learning more about the Cheyenne River Sioux Tribe.

Please contact me at (605) 385-2801 if you have any questions. If deemed helpful, you may also have someone contact Mr. John Morgenstern, my natural and cultural resources manager, at (605) 385-2690.

Sincerely

A handwritten signature in black ink, appearing to read "J. Taliaferro", written over a printed name.

JEFFREY B. TALIAFERRO, Colonel, USAF

Attachment:  
Official Biography

*Global Power For America*

*Final  
November 2014*



**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

**AUG 05 2009**

Colonel Jeffrey B. Taliaferro  
Commander, 28th Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Ron His Horse Is Thunder, Chairman  
Standing Rock Sioux Tribal Council  
PO Box D  
Fort Yates ND 58538

Dear Chairman His Horse Is Thunder

Having recently assumed command of the 28th Bomb Wing, I am writing to introduce myself and respectfully request a meeting to continue the government-to-government relationship and meaningful dialogue between the Standing Rock Sioux Tribe and Team Ellsworth.

I believe meeting will help us both better understand our unique perspectives and continue the meaningful dialogue initiated by Colonel Vander Hamm between the Standing Rock Sioux Tribe and Team Ellsworth. Our discussions must be open and honest, respecting each other's cultures, and trusting of each other's desire to maintain a healthy relationship. My goal for this consultation is to get to know you and other members of the tribal council. If you have other specific issues you'd like to discuss when we meet, please feel free to contact me prior to the scheduled meeting so I can arrive more prepared, and we can make the meeting more productive.

We welcome you and other members of the tribal council to visit Ellsworth Air Force Base as it would give us an opportunity to provide you with a base tour. If you'd prefer to meet on the reservation or elsewhere, please let me know the dates you are available. I look forward to meeting you and learning more about the Standing Rock Sioux Tribe.

Please contact me at (605) 385-2801 if you have any questions. If deemed helpful, you may also have someone contact Mr. John Morgenstern, my natural and cultural resources manager, at (605) 385-2690.

Sincerely

A handwritten signature in black ink, appearing to read "Jeffrey B. Taliaferro".

JEFFREY B. TALIAFERRO, Colonel, USAF

Attachment:  
Official Biography

*Global Power For America*



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*November 2014*



**DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS 28TH BOMB WING (ACC)  
ELLSWORTH AIR FORCE BASE SOUTH DAKOTA**

**AUG 05 2009**

Colonel Jeffrey B. Taliaferro  
Commander, 28th Bomb Wing  
1958 Scott Drive, Ste 1  
Ellsworth AFB SD 57706-4710

Carl Venne, Chairman  
Crow Tribal Council  
PO Box 169  
Crow Agency MT 59022

Dear Chairman Venne

Having recently assumed command of the 28th Bomb Wing, I am writing to introduce myself and respectfully request a meeting to continue the government-to-government relationship and meaningful dialogue between the Crow Tribe and Team Ellsworth.

I believe meeting will help us both better understand our unique perspectives and continue the meaningful dialogue initiated by Colonel Vander Hamm between the Crow Tribe and Team Ellsworth. Our discussions must be open and honest, respecting each other's cultures, and trusting of each other's desire to maintain a healthy relationship. My goal for this consultation is to get to know you and other members of the tribal council. If you have other specific issues you'd like to discuss when we meet, please feel free to contact me prior to the scheduled meeting so I can arrive more prepared, and we can make the meeting more productive.

We welcome you and other members of the tribal council to visit Ellsworth Air Force Base as it would give us an opportunity to provide you with a base tour. If you'd prefer to meet on the reservation or elsewhere, please let me know the dates you are available. I look forward to meeting you and learning more about the Crow Tribe.

Please contact me at (605) 385-2801 if you have any questions. If deemed helpful, you may also have someone contact Mr. John Morgenstern, my natural and cultural resources manager, at (605) 385-2690.

Sincerely

A handwritten signature in black ink, appearing to read "J. Taliaferro".

JEFFREY B. TALIAFERRO, Colonel, USAF

Attachment:  
Official Biography

*Global Power For America*

**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
THE STATE HISTORIC PRESERVATION OFFICES OF  
MONTANA, NORTH DAKOTA, SOUTH DAKOTA AND WYOMING,  
AND  
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION  
REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

**WHEREAS**, the United States Air Force (AF), represented by the 28<sup>th</sup> Bomb Wing (hereafter “the 28 BW”), operates and maintains Ellsworth Air Force Base (EAFB), South Dakota, and

**WHEREAS**, the 28 BW is responsible for identifying and managing historic properties at EAFB and identifying and considering effects to historic properties in areas used by the base for training, pursuant to Section 106 of the National Historic Preservation Act (NHPA) (16 USC §470f) and its implementing regulation, 36 CFR Part 800 (hereafter jointly referred to as “Section 106”); and

**WHEREAS**, the 28 BW proposes to establish the Powder River Training Complex (PRTC) to provide suitable and realistic training for military aircrews of multiple B-1 and B-52 squadrons assigned primarily to EAFB and Minot AFB, North Dakota. It would restructure and reconfigure the existing Powder River Military Operations Areas (MOAs) and associated Air Traffic Control Assigned Airspaces (ATCAAs) and add airspaces to become the PRTC. The establishment, development, and operation of the PRTC (also referred to in this document as “the undertaking”) would overlay about 35,000 square miles or 22.5 million acres in South Dakota, North Dakota, Montana, and Wyoming (Attachment 1), the lands beneath the PRTC airspace constituting the area of potential effect to historic properties; and

**WHEREAS**, the PRTC would designate the following training areas: Powder River (PR)-1A through 1D, PR-2, PR-3, PR-4 MOA/ATCAA; GAP A, B, and C MOA/ATCAA; and Gateway East and West MOA/ATCAA, as depicted in Attachments 1 and 2; and

**WHEREAS**, the PRTC would not require construction or other ground disturbance within the complex or at the using installations; supersonic flights for both fighter and bomber aircraft within the PRTC would occur only during Large Force Exercises (LFEs) which could be held quarterly but total no more than ten (10) days per year; an altitude of 10,000 feet above ground level (AGL) is proposed as the supersonic floor for all fighter aircraft during LFEs and 20,000 feet above mean sea level (MSL) is proposed as the floor for B-1 supersonic flight during LFEs; chaff bundles and flares would be employed throughout the PRTC airspace for countermeasures training with flares being used only at or above 2,000 feet AGL and only if conditions are suitable; and

**WHEREAS**, some 240 National Register of Historic Places (NRHP) listed properties are located beneath the PRTC airspace, including several National Historic Landmarks (NHLs) and Monuments (Attachment 3), as well as hundreds of recorded and unrecorded NRHP eligible archaeological sites, ghost towns, historic ranches, cultural landscapes, and places of traditional, religious, and cultural importance; and

**WHEREAS**, 28 BW has determined that the undertaking may have potential adverse effects that cannot be identified or anticipated today, that the potential exists for discovery of new historic properties in the PRTC and for changes in how such properties are understood and appreciated; and

**WHEREAS**, the AF and the Federal Aviation Administration (FAA) , Central Service Center agree that, pursuant to 36 CFR §800.2(a)(2), the AF is hereby designated as the lead federal agency for purposes of compliance with Section 106 for the PRTC undertaking and the FAA is an invited signatory to this programmatic agreement (hereafter “PA”); and

**WHEREAS**, the AF is the lead agency and the FAA is a cooperating agency under the National Environmental Policy Act (NEPA) for development of the Environmental Impact Statement (EIS) for the PRTC proposal; and

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**WHEREAS**, pursuant to 36 CFR §800.10(b) and 36 CFR §800.6(a)(1)(iii), the 28 BW has requested and received the participation of the Advisory Council on Historic Preservation (ACHP) in consultations leading to the development of this PA and to become a signatory to this PA; and

**WHEREAS**, the 28 BW has consulted with the State Historic Preservation Officers (hereafter “SHPOs”) of Montana, North Dakota, South Dakota, and Wyoming to identify historic properties on lands within said states under the PRTC, and to discuss potential adverse effects from the proposed undertaking, and

**WHEREAS**, the 28 BW has consulted with the National Park Service (NPS) to identify historic properties on lands managed by it under the PRTC, and to assess adverse effects from overflights associated with the undertaking; and

**WHEREAS**, the 28 BW recognizes the additional requirements, per 36 CFR §800.10, for NHLs and specifically for Bear Butte, Frawley Historic Ranch, Deadwood Historic District, Deer Medicine Rocks, Wolf Mountains Battlefield/Where Big Crow Walked Back and Forth NHL, and Rosebud Battlefield which are situated on lands under or immediately adjacent to the existing training airspace of PRTC, and that the 28 BW requested and confirmed participation of the NPS and the ACHP in this consultation; and

**WHEREAS**, the U.S. Air Force Air Combat Command in June 2008 contacted tribes outside the APE that may have traditional cultural and religious affiliations to lands under the PRTC, including Spirit Lake Sioux Tribal Council, the Fort Peck Tribal Executive Board, the Fort Belknap Community Council, the Confederated Salish and Kootenai Tribe, the Oglala Sioux Tribal Council, the Arapaho Business Council, the Rosebud Sioux Tribe, the Eastern Shoshone Tribal Council, the Three Affiliated Tribes Business Council, the Turtle Mountain Tribal Council, and the Chippewa-Cree Business Committee; and

**WHEREAS**, the 28 BW consulted on the PRTC proposal since 2008 with the Cheyenne River Sioux Tribe, the Crow Tribe, the Northern Cheyenne Tribe, and the Standing Rock Sioux Tribe (hereafter, “Tribes”), each of which have tribal lands underneath the PRTC where military overflights, but no ground activities, would occur and provided each Tribe opportunities to consult on the development of and to become invited signatories to this PA; and

**WHEREAS**, the 28 BW has provided the Tribes opportunities to identify historic properties of traditional religious and cultural importance under the PRTC airspace, and on which the 28 BW will continue to consult through its devised continual approach to identify and evaluate properties of religious and cultural significance to Indian tribes in conjunction with the operation of the PRTC; and

**WHEREAS**, 28 BW solicited the views of the public on the PRTC through public hearings and other means associated with NEPA, in accordance with 36 CFR §§800.2(d)(3) and 800.8(a); and

**WHEREAS**, the NPS, Intermountain Region, and the Little Bighorn Battlefield National Monument intend to undertake a multi-year acoustic monitoring program and a visitor use study that will survey visitors regarding sounds that a visitor would expect at a national battlefield and investigate particular military aircraft noises and associated annoyance levels as a result of the PRTC;

**NOW, THEREFORE**, the 28 BW, the FAA, the NPS, the SHPOs, and the ACHP agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties.

**STIPULATIONS**

**I. Avoidance, Minimization, or Mitigation of Adverse Effects to Historic Properties under the PRTC**

- A. Great Sioux War Battlefields: Little Bighorn Battlefield National Monument (Monument), Montana
1. 28 BW shall:
    - a) Ensure that all military aircraft, when overflying the area of the Monument indicated on the map in Attachment 4 of this PA:
      - (1) Maintain an altitude of at least 5,000 feet AGL from one (1) hour before to one (1) hour after posted Hours of Operation of Little Bighorn Battlefield National Monument.
      - (2) Consider further restrictions of planned and potential PRTC activities during special events at the Monument.
    - b) Prohibit supersonic operation of aircraft when overflying the Little Bighorn Supersonic Avoidance Area above the area bounded by Powder River 1C, as indicated on the map in Attachment 4.
    - c) Coordinate on plans for multi-year acoustic monitoring in the Monument when requested by the NPS.
    - d) Coordinate on plans for a visitor use study when requested by the NPS.
  2. NPS shall promptly inform the 28 BW of military aircraft overflights of the Monument that are contrary to the stipulations immediately above, within 24 hours of the overflight event.
- B. Great Sioux War Battlefields historic properties in Montana, South Dakota, and North Dakota other than the Monument including, but not limited to, Deer Medicine Rocks and Wolf Mountains Battlefield/Where Big Crow Walked Back and Forth; and archaeological locations containing sensitive rock art throughout the area of potential effect, including the Tongue River Valley, Chalk Butte, and Slim Butte, Montana and North and South Cave Hills, South Dakota
1. 28 BW shall:
    - a) Work cooperatively with other federal and state agencies, tribal governments, and the public to minimize potential adverse effects to historic properties in the PRTC from routine operations or from LFEs.
    - b) Energetically comply with the procedures in Stipulations III through V. The effectiveness of these procedures depends in part on the actions of consulting parties and the public to inform the 28 BW of potential adverse effects from military operations or non-compliance with the requirements of this agreement; see Stipulation IX.B.
    - c) Consult with the relevant consulting parties on appropriate responses, if, as a result of notifications and follow on assessments by the 28 BW, further mitigating actions may be required.

**II. Avoidance, Minimization, or Mitigation of Adverse Effects to Historic Properties, Religious Ceremonies, and Important Tribal Events under the PRTC**

- A. The 28 BW shall continue to consult with the Tribes on appropriate ways to avoid, minimize, or mitigate adverse effects to historic properties, religious ceremonies, and events important to the Tribes.
1. This includes 28 BW authorizing reasonable temporary or seasonal avoidance areas for training objectives during the following events after consulting with the appropriate Tribe:
    - a) the “Crow Fair” of the Crow Tribe (PR-1A and PR-1C)
    - b) the “4th of July Chiefs Powwow” of the Northern Cheyenne Tribe (PR-1D)
    - c) the “Porcupine Powwow” of the Standing Rock Sioux Tribe (PR-4)
    - d) the “Fair Rodeo and Labor Day Powwow” of the Cheyenne River Tribe (PR-4);  
or
    - e) other events, now and in the future as identified by 28 BW in consultation with the Tribes.
  2. Within six (6) months of executing this PA, 28 BW shall appoint a senior-level installation person as a Tribal Liaison to serve as the primary point of contact in facilitation of the government-to-government relationships with the Tribes, and coordinating and directing the 28 BW’s participation in joint efforts.
    - a) Until such position is designated, the 28 BW Airspace Manager shall serve as the interim liaison.
    - b) The 28 BW will advise the Tribes within one (1) month of any changes to this liaison position.
  3. 28 BW shall meet with Tribal leaders at least annually to review PRTC-related activities that may affect historic properties of traditional and religious importance to the Tribes.
- B. A Tribe that is an invited signatory to this PA shall:
1. Designate a point of contact (POC) to act as liaison with the 28 BW Tribal Liaison to coordinate and direct tribal participation identified in this PA, and advise the 28 BW in a timely manner of any changes to this position.
  2. Provide appropriate information to the 28 BW regarding historic properties, to include properties of traditional religious and cultural importance, which may be affected by military aircraft training that would occur in the PRTC and adjacent areas, when requested by the 28 BW.
  3. Review and provide comments on draft Air Force plans, programs, and reports for PRTC training and operations, upon request by the 28 BW. Negative replies are requested if no comments will be forthcoming. Planning responsibilities often require 28 BW to set timelines for responses. The 28 BW leadership will consider all comments received within these timelines when making a decision. Responses received after a timeline expires will be considered if practicable.

**III. Awareness Training for Military Trainers and Aircrews Operating in the PRTC**

- A. 28 BW shall:
1. Prepare, within three (3) months of executing this PA, a comprehensive in-brief presentation covering current operating procedures, to include cultural sensitivities and mitigation procedures for flying units preparing to train in the PRTC airspace prior to their training within the PRTC.
    - a) Ensure all military aircrews participating in the LFEs be certified by their Unit Commander that they have received this comprehensive in-brief.
    - b) Include a summary of all training provided in the annual report in accordance with Stipulation VII.
  2. Host an annual Cultural Awareness class for military aircrews to ensure tribal, SHPO, and federal agency cultural concerns are communicated properly.
    - a) Invite each Tribe, SHPO, and federal agency that has signed this PA to produce and present at the Cultural Awareness classes and offer travel and per diem expenses.
    - b) Include summaries of recent classes in the annual and five year updates of the EAFB Integrated Cultural Resources Management Plan (ICRMP).

**IV. Avoidance Protocol**

- A. Within six (6) months of executing this PA, 28 BW shall develop and implement a program to accept requests from consulting parties to avoid training in portions of the PRTC.
- B. The 28 BW shall consider requests from consulting parties to avoid using portions of the PRTC, said requests to include dates and approximate locations, preferably with coordinates, that should be avoided, no later than seven (7) to ten (10) days prior to the date of avoidance being sought.

**V. Supersonic/Large Force Exercise (LFE) Notification**

The 28 BW shall notify consulting parties fifteen (15) days prior to the use of supersonic operations and an LFE. Supersonic operations will take place only during LFEs, which occur at a maximum of ten days a year.

**VI. Integrated Cultural Resource Management Plan (ICRMP) Revision**

The 28 BW shall incorporate the activities mandated by the stipulations of this agreement into the procedures, goals, and objectives of the base ICRMP, to be completed by the date of its next five year update, estimated to be 2016. The 28BW shall provide draft, updated versions of the ICRMP to the parties to this PA. These parties may review and comment on the ICRMP and/or provide additional relevant information relevant to PRTC operations and historic properties as they deem appropriate.

**VII. Monitoring and Reporting**

- A. On March 1, starting in 2015, the 28 BW shall send a request to consulting parties, except the ACHP, for information pertaining to any additional historic properties or adverse effects identified during the previous operational year of the PRTC by that consulting party.
- B. Each May 1, starting in 2015, the BW shall provide all consulting parties, except for the ACHP, a summary report detailing the following:

- 1) the number of training exercises completed;
- 2) any scheduling changes proposed for military training in the PRTC;
- 3) any problems encountered with implementing the terms of this agreement;
- 4) any disputes or objections received as appropriate;
- 5) a summary of newly identified properties;
- 6) a summary of newly identified adverse effects; and
- 7) a meeting date to discuss the contents of the summary report.

**VIII. Confidentiality**

- A. Consistent with Section 304 of the NHPA, 36 CFR §800.11(c), the Archaeological Resources Protection Act (ARPA), and other applicable laws, 28 BW, after consultation with the Secretary of the Interior, shall withhold from public disclosure information about the location, character, or ownership of a historic property when disclosure may cause significant invasion of privacy, risk harm to a historic property, or impede the use of a traditional religious site by practitioners.
  1. Access to sensitive data, as defined in Section 304 of the NHPA, will be limited within 28 BW to individuals designated by the Wing Commander.
  2. Requests from parties external to this agreement for access to sensitive data on PRTC related historic and traditional properties held by the AF shall be considered jointly by 28 BW, SHPO/THPO, Tribes, and NPS as appropriate.
- B. All parties shall attempt to resolve disputes regarding access to sensitive data in a timely manner, not to exceed sixty (60) days. If a dispute regarding access to sensitive data cannot be resolved, 28 BW shall defer to the facility manager of public buildings, the land manager on public lands, the tribe on tribal lands, or in the case of privately owned lands, to the SHPO.

**IX. Air Force Claims Program/Post Review Discovery**

- A. The 28 BW, through its Public Affairs Office, shall, in the event of damages, injuries, or complaints associated with military operations in the PRTC, accept descriptive documentation and facilitate processing to the Air Force claims program. Contact the Public Affairs Office at (605) 385-5056 between 8:00 am and 5:00 pm, Monday through Friday, or via email at [28.bw.public.affairs@ellsworth.af.mil](mailto:28.bw.public.affairs@ellsworth.af.mil). The Public Affairs Office will immediately notify the Office of the Staff Judge Advocate of any potential claims. The Public Affairs Office shall maintain documentation of such reports and actions taken by the Air Force in response. This documentation will be summarized in a report and made available to the consulting parties annually, beginning one year after execution of this PA.
- B. In the event of the 28 BW becoming aware of a discovery within the PRTC APE of damage to historic properties as a result of PRTC operations, the discovery of previously unidentified adverse effects, or of non-compliance with the terms of this agreement by any consulting party, the 28 BW shall notify the appropriate SHPO/Tribe within 72 hours, providing a brief but detailed report. The 28 BW, after consultation with the appropriate SHPO/Tribe, will determine the appropriate response to any such discovery.

**X. Duration**

- A. This PA will be valid for five (5) years from the date of execution.

- B. At the conclusion of five (5) years from the date of execution, the signatories and invited signatories to the PA may carry out a review of the PA in order to determine if revisions to the PA are needed and to determine if the PA may continue for an additional five (5) years. If the signatories and invited signatories agree to the extension, the agreement will be documented in an amendment to this PA which will be signed by the signatories and invited signatories in accordance with Stipulation XIII.

**XI. Compliance with the Anti-Deficiency Act**

Any requirement established by the PA for the expenditure of Department of the Air Force funds by the 28 BW shall be subject to the availability of appropriated funds, and no provision herein shall be interpreted to require obligation or payment of funds in violation of the Anti-Deficiency Act (31 USC 1341). In the event that the 28 BW is unable to carry out one or more terms of this agreement due to the provisions of the Anti-Deficiency Act, the 28 BW shall advise the parties to this PA, and shall otherwise comply with pertinent requirements of this PA as appropriate.

**XII. Dispute Resolution**

Should any signatory or invited signatory to this PA object at any time to any actions proposed or the manner in which the terms of this PA are implemented, the 28 BW shall consult with such party to resolve the objection. If the 28 BW determines that such objection cannot be resolved, the 28 BW will:

- A. Forward all documentation relevant to the dispute, including the 28 BW's proposed resolution, to the ACHP. The ACHP shall provide the 28 BW with its advice on the resolution of the objection within thirty (30) calendar days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the 28 BW shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and consulting parties, and provide them with a copy of this written response. The 28 BW will then proceed according to its final decision.
- B. If the ACHP does not provide its advice regarding the dispute within the thirty (30) day time period, the 28 BW may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the 28 BW shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and consulting parties to the PA, and provide them and the ACHP with a copy of such written response.
- C. The 28 BW's responsibility to carry out all other actions subject to the terms of this PA that are not the subject of the dispute remain unchanged.

**XIII. Amendments**

- A. Any signatory to this Agreement may request that it be amended or modified. Any resulting amendments or addenda shall be developed and executed in the same manner as this original PA.
- B. The amendment or addenda will become effective on the date a copy is signed by all signatories and is filed with the ACHP.

**XIV. Termination**

- A. If any signatory to this PA determines that its terms will not or cannot be carried out, that party shall immediately consult with the other parties to attempt to develop an amendment per Stipulation XIII above. If within (30) calendar days (or another time period agreed to by all signatories) an amendment cannot be reached, any signatory may withdraw from the PA upon written notification to the other signatories. Withdrawal by a SHPO or Tribe will terminate this PA only with respect to matters within the jurisdiction of that SHPO or Tribe.



- B. If any signatory withdraws from this PA, the remaining signatories shall consult and determine whether the PA shall continue in force with respect to matters within their jurisdiction. If said parties determine that the PA shall be terminated, the 28 BW must, as soon as practicable, either (a) execute a Memorandum of Agreement pursuant to 36 CFR §800.6, (b) execute a revised PA pursuant to 36 CFR §800.14(b)(3), or (c) request, take into account, and respond to the comments of the ACHP under 36 CFR §800.7. The 28 BW shall notify the signatories as to the course of action it will pursue. The parties agree that all flying activities and measures in this PA to resolve adverse effects will continue in effect while 28 BW implements its decision.

**XV. Signatories**

- A. This PA shall be executed in counterpart, with a separate page for each signatory and invited signatory, and when combined will constitute the whole agreement. 28 BW shall ensure that each party is provided with a fully executed copy. This PA will become effective regarding historic properties in Montana, North Dakota, South Dakota, and Wyoming on the date of the last signature by 28 BW, the SHPO for each of those states, and the ACHP.
- B. Additional federal agencies may be included in this PA as an invited signatory without its amendment if 28 BW notifies the current signatories and invited signatories in writing of the proposal and there is no objection from the current signatories or invited signatories within thirty (30) days of 28 BW's written notice. If no response is received within thirty (30) days, 28 BW may assume concurrence with the addition of the federal agency to this PA. 28 BW shall ensure that each consulting party is provided with an updated copy of the PA.
- C. If Cheyenne River Sioux Tribe, the Crow Tribe, the Northern Cheyenne Tribe, or the Standing Rock Sioux Tribe chose to sign this PA as an invited signatory after the execution of the PA, it may do so without an amendment to the PA if 28 BW notifies the current signatories and invited signatories in writing of the proposal. 28 BW shall ensure that each consulting party is provided with an updated copy of the PA.

**EXECUTION** of this PA and implementation of its terms evidence that the 28 BW has taken into account the effects of the PRTC undertaking on historic properties and afforded the ACHP an opportunity to comment.


*Final*  
*November 2014*

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**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
THE STATE HISTORIC PRESERVATION OFFICES OF  
MONTANA, NORTH DAKOTA, SOUTH DAKOTA AND WYOMING,  
AND  
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION  
REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

SIGNATORY

28 BW, UNITED STATES AIR FORCE

By:   
KEVIN B. KENNEDY, COL, USAF  
Commander, 28 Bomb Wing

Date: 8 July 2014

*PA Regarding Development, Implementation, and Operation of the Powder River Training Complex: 07 July 2014 Version*

*Final*  
*November 2014*

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PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
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SIGNATORY

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By:   
JOHN M. FOWLER

Date: 9/4/14

*PA Regarding Development, Implementation, and Operation of the Powder River Training Complex: 07 July 2014 Version*

PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
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MONTANA, NORTH DAKOTA, SOUTH DAKOTA AND WYOMING,  
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OF THE POWDER RIVER TRAINING COMPLEX

SIGNATORY

MONTANA STATE HISTORIC PRESERVATION OFFICE

By:  \_\_\_\_\_  
MARK BAUMLER  
State Historic Preservation Officer

Date: 

**Final  
November 2014**

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**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
THE STATE HISTORIC PRESERVATION OFFICES OF  
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THE ADVISORY COUNCIL ON HISTORIC PRESERVATION  
REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

SIGNATORY

NORTH DAKOTA STATE HISTORIC PRESERVATION OFFICE

By:  Date: 8-4-14  
MERLIN E. PAAVERUD, Jr.  
State Historic Preservation Officer

*PA Regarding Development, Implementation, and Operation of the Powder River Training Complex: 07 July 2014 Version*

*Final*  
*November 2014*

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**PROGRAMMATIC AGREEMENT  
AMONG  
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THE STATE HISTORIC PRESERVATION OFFICES OF  
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REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

SIGNATORY

SOUTH DAKOTA STATE HISTORIC PRESERVATION OFFICE

By: Jay D. Vogt Date: 07-11-2014  
JAY D. VOGT  
State Historic Preservation Officer

*PA Regarding Development, Implementation, and Operation of the Powder River Training Complex: 07 July 2014 Version*

**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
THE STATE HISTORIC PRESERVATION OFFICES OF  
MONTANA, NORTH DAKOTA, SOUTH DAKOTA AND WYOMING,  
AND  
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION  
REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND  
OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

- A. Entirety of Agreement. This PA, consisting of thirty (30) pages, represents the entire and integrated agreement between the parties and supersedes all prior negotiations, representations and agreements, whether written or oral, regarding compliance with Section 106 of the National Historic Preservation Act for those aspects of the Proposed Development, Implementation and Operation of the Powder River Training Complex throughout the visual APE that will or may have adverse effects on the settings of historic properties.
- B. Prior Approval. This PA shall not be binding upon any party unless this PA has been reduced to writing before performance begins as described under the terms of this PA, and unless the PA is approved as to form by the Attorney General or his representative.
- C. Severability. Should any portion of this PA be judicially determined to be illegal or unenforceable, the remainder of the PA shall continue in full force and effect, and any party may renegotiate the terms affected by the severance.
- D. Sovereign Immunity. The State of Wyoming and the WYSHPO do not waive their sovereign or governmental immunity by entering into this PA and each fully retains all immunities and defenses provided by law with respect to any action based on or occurring as a result of the PA.

SIGNATORY FOR THE AIR FORCE  
28 BW, UNITED STATES AIR FORCE

By:  Date: 31 July 2014  
KEVIN B. KENNEDY, COL, USAF  
Commander, 28th Bomb Wing

SIGNATORIES FOR THE STATE OF WYOMING  
WYOMING STATE HISTORIC PRESERVATION OFFICE

By:  Date: 8/20/14  
MARY HOPKINS  
State Historic Preservation Officer

WYOMING ATTORNEY GENERAL

By:  Date: 8-19-14  
Steve Caton # 118477


**Final  
November 2014**

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**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
THE STATE HISTORIC PRESERVATION OFFICES OF  
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THE ADVISORY COUNCIL ON HISTORIC PRESERVATION  
REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

INVITED SIGNATORY

FEDERAL AVIATION ADMINISTRATION

By:  Date: 7-22-2014  
KENT M. WHEELER  
Manager  
Operations Support Group  
ATO Central Service Center, AJV-C2

*PA Regarding Development, Implementation, and Operation of the Powder River Training Complex: 07 July 2014 Version*



PROGRAMMATIC AGREEMENT  
AMONG  
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INVITED SIGNATORY

NATIONAL PARK SERVICE

By: *Sue E. Masica* Date: 8/5/14  
SUE E. MASICA  
Director, Intermountain Region

**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
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OF THE POWDER RIVER TRAINING COMPLEX**

INVITED SIGNATORY

CHEYENNE RIVER SIOUX TRIBE

By: \_\_\_\_\_ Date: \_\_\_\_\_  
Name  
Title

**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
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REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

INVITED SIGNATORY

CROW TRIBE

By: \_\_\_\_\_  
Name  
Title

Date: \_\_\_\_\_

**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
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REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

INVITED SIGNATORY

NORTHERN CHEYENNE TRIBE

By: \_\_\_\_\_ Date: \_\_\_\_\_  
Name  
Title

**PROGRAMMATIC AGREEMENT  
AMONG  
28<sup>th</sup> BOMB WING, ELLSWORTH AIR FORCE BASE,  
THE STATE HISTORIC PRESERVATION OFFICES OF  
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AND  
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION  
REGARDING THE PROPOSED DEVELOPMENT, IMPLEMENTATION AND OPERATION  
OF THE POWDER RIVER TRAINING COMPLEX**

INVITED SIGNATORY

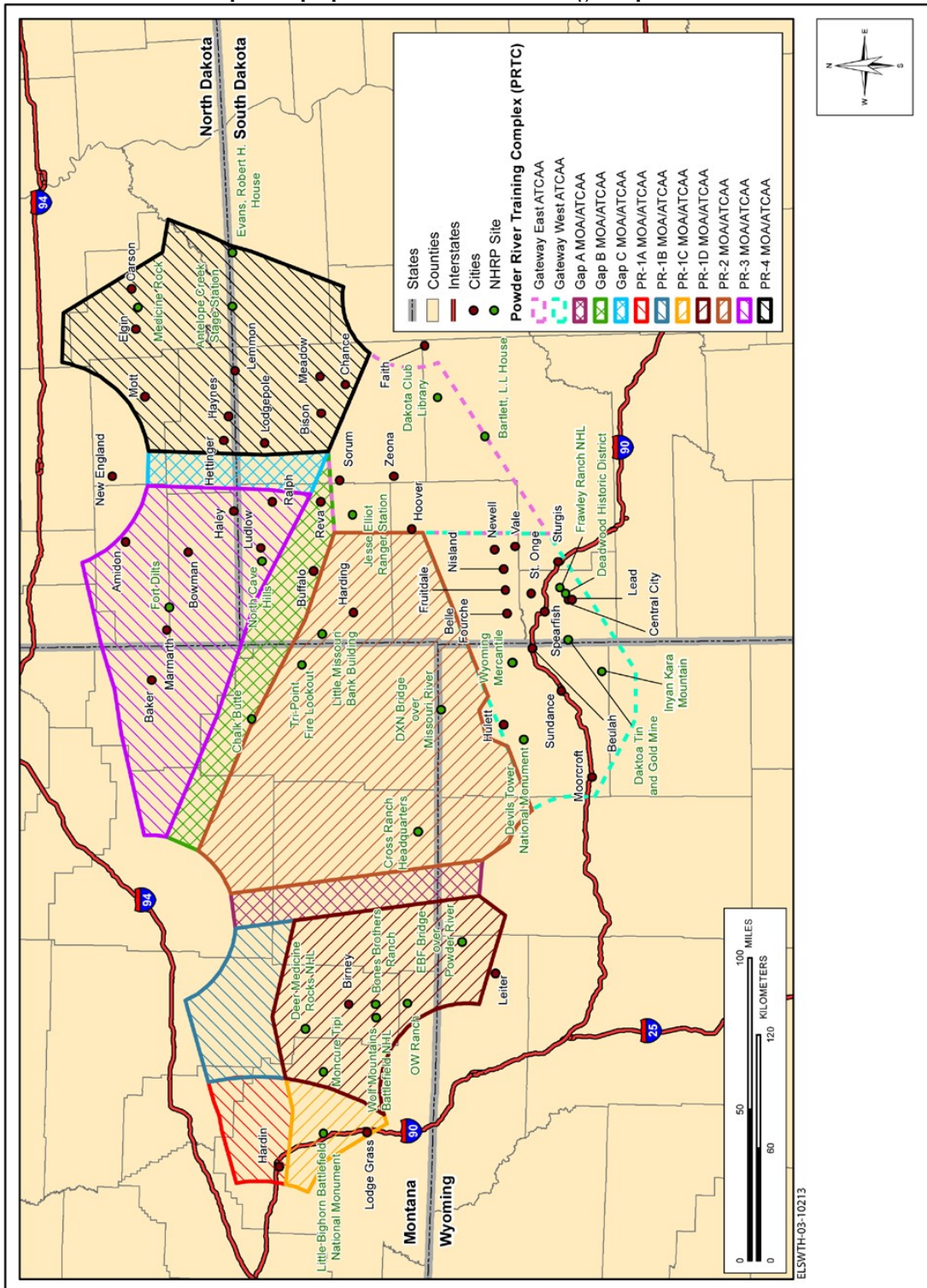
STANDING ROCK SIOUX TRIBE

By: \_\_\_\_\_ Date: \_\_\_\_\_  
Name  
Tribe

**LIST OF ATTACHMENTS**

1. Map of the proposed Powder River Training Complex (PRTC) and selected historic sites
2. Proposed PRTC MOA/ATCAA Complexes
3. Table describing National Register of Historic Places listed properties beneath the PRTC airspace (in multiple sub-tables)
4. Map of the Little Bighorn National Battlefield Monument Area per Stipulation I.A.1.

Attachment 1: Map of the proposed Powder River Training Complex and selected historic sites



PA Regarding Development, Implementation, and Operation of the Powder River Training Complex: 27 June 2014 Version

<b>Attachment 2. Proposed PRTC MOA/ATCAA Complexes</b>	
<b>MOA</b>	<b>Description</b>
Powder River 1 MOA complex (PR-1)	Consists of PR-1A, PR-1B, PR-1C, and PR-1D MOAs, each of which would be stratified vertically into a Low MOA, a High MOA, and an ATCAA.*
Powder River 2 MOA complex (PR-2)	Consists of the PR-2 MOAs, which would be stratified vertically into a Low MOA, a High MOA, and an ATCAA*
Powder River 3 MOA complex (PR-3)	Consists of the PR-3 MOAs, which would be stratified vertically into a Low MOA, a High MOA, and an ATCAA*
Powder River 4 MOA	Consists of the PR-4 MOAs, which would be stratified vertically into a High MOA, and an ATCAA*
GAP A MOA	Separate PR-1 and PR-2, would consist of a Low MOA, a High MOA, and an ATCAA*
GAP B MOA	Separate PR-2 and PR-3, would consist of a Low MOA, a High MOA, and an ATCAA*
GAP C MOA	Separate PR-3 and PR-4, would consist of a Low MOA, a High MOA, and an ATCAA*
Gateway ATCAA	Modified and expanded to create the Gateway West and Gateway East ATCAAs*

*\*Note:* For the purposes of the definitions above: Low MOA = altitudes from 500 feet AGL up to, but not including 12,000 feet MSL High MOA = altitudes from 12,000 feet MSL up to, but not including 18,000 feet MSL ATCAA = altitudes from 18,000 feet MSL up to 26,000 feet MSL



**Attachment 3: Historic Properties in the PRTC APE (in multiple sub-tables)**

<b>Table 3a. National Register Properties Under Proposed PRTC Airspace</b>		
<b>An * indicates that the property is located within the ATCAAs with altitudes from 18,000 feet MSL to 60,000 feet</b>		
<b>Property Name</b>	<b>General Location (County/Town)</b>	<b>Airspace</b>
<b>Wyoming</b>		
Arch Creek Petroglyphs*	Crook/Moorcroft	Gateway West ATCAA
DXN Bridge over Missouri River	Crook/Hulett	PR-2
EBF Bridge over Powder River	Sheridan/Leiter	PR-1
Entrance Road—Devils Tower National Monument*	Crook/Devils Tower	Gateway West ATCAA
Entrance Station—Devils Tower National Monument*	Crook/Devils Tower	Gateway West ATCAA
Inyan Kara Mountain*	Crook/Sundance	Gateway West ATCAA
McKean Archaeological Site*	Crook/Moorcroft	Gateway West ATCAA
Old Headquarters Area Historic District*	Crook/Devils Tower	Gateway West ATCAA
Ranch A	Crook/Beulah	Gateway West ATCAA
Sundance School*	Crook/Sundance	Gateway West ATCAA
Sundance State Bank*	Crook/Sundance	Gateway West ATCAA
Tower Ladder-Devils Tower National Monument	Crook/Devils Tower	Gateway West ATCAA
Vore Buffalo Jump*	Crook/Sundance	Gateway West ATCAA
Wyoming Mercantile	Crook/Aladdin	Gateway West ATCAA
<b>Montana</b>		
Baker Hotel	Fallon/Baker	PR-3
Baldwin House	Big Horn/Lodge Grass	PR-1
Bones Brother Ranch	Rosebud/Birney	PR-1
Boyum, John, House	Big Horn/Hardin	PR-1
Burke, Thomas H., House	Big Horn/ Hardin	PR-1
Cammocks' s Hotel	Big Horn/Lodge Grass	PR-1
Chivers Memorial Church	Big Horn/Lodge Grass	PR-1
Commercial District	Big Horn/Hardin	PR-1
Cross Ranch Headquarters	Powder River/Broadus	PR-2
Deer Medicine Rocks National Historic Landmark	Rosebud	PR-1
Drew, J. W., Grain Elevator	Big Horn/Lodge Grass	PR-1
Ebeling, William, House	Big Horn/Hardin	PR-1
Eder, Charles S., House	Big Horn/Hardin	PR-1
Fallon County Jail	Fallon/Baker	PR-3
First Baptist Church	Big Horn/Hardin	PR-1
Haverfield Hospital	Big Horn/Hardin	PR-1
Kopriva, Francis, House	Big Horn/Hardin	PR-1
Little Bighorn Battlefield National Monument	Big Horn/Hardin	PR-1
Lodge Grass City Jail	Big Horn/Lodge Grass	PR-1
Lodge Grass Merchandise Company Store	Big Horn/Lodge Grass	PR-1
Moncure Tipi	Big Horn/Busby	PR-1
OW Ranch	Big Horn/Birney	PR-1
Pease' s George, Second Store	Big Horn/Lodge Grass	PR-1
Ping, J. J., House	Big Horn/Hardin	PR-1
Reno Apartments	Big Horn/Hardin	PR-1
Residential District	Big Horn/Hardin	PR-1
Ryan' s, John, House	Big Horn/ Lodge Grass	PR-1
Sharp' s Jay, Store	Big Horn/Lodge Grass	PR-1
Simmonsens' s House	Big Horn/Lodge Grass	PR-1
St. Joseph' s Catholic Church	Big Horn/Hardin	PR-1
Stevens, Dominic House	Big Horn/Lodge Grass	PR-1
Sullivan Rooming House	Big Horn/Hardin	PR-1
Sullivan, James J., House	Big Horn/Hardin	PR-1
Trytten, J. M., House	Big Horn/Lodge Grass	PR-1
Tupper, J. S., House	Big Horn/Hardin	PR-1
Wolf Mountains Battlefield/Where Big Crow Walked Back and Forth NHL	Rosebud/Birney	PR-1

<b>Table 3a. National Register Properties Under Proposed PRTC Airspace</b>		
<b>An * indicates that the property is located within the ATCAAs with altitudes from 18,000 feet MSL to 60,000 feet</b>		
<b>Property Name</b>	<b>General Location (County/Town)</b>	<b>Airspace</b>
<b>North Dakota</b>		
Adams County Courthouse	Adams/Hettinger	PR-4
Carson Roller Mill	Grant/Carson	PR-4
Cedar Creek Bridge	Adams/Haynes	PR-4
Fort Dilts	Bowman/Rhame	PR-3
Hettinger County Courthouse	Hettinger/Mott	PR-4
Hettinger U.S. Post Office –	Adams/Hettinger	PR-4
Hope Lutheran Church	Grant/Elgin	PR-4
H-T Ranch	Slope/Amidon	PR-3
Medicine Rock State Historic Site	Grant/Heil	PR-4
Mystic Theatre	Slope/Marmarth	PR-3
Neuburg Congregational Church	Hettinger/Mott	PR-4
Original Slope County Courthouse	Slope/Amidon	PR-3
Riverside	Hettinger/New England	PR-4
Schade, Emma Petznick and Otto, House	Bowman/Bowman	PR-3
Stern, John and Fredricka (Roth), Homestead	Hettinger/Mott	PR-4
<b>South Dakota</b>		
Ainsworth, Oliver N., House*	Lawrence/Spearfish	Gateway West ATCAA
Antelope Creek Stage Station	Corson/Morristown	PR-4
Archaeological Site No. 39HN1	Harding/Ludlow	PR-3
Archaeological Site No. 39HN5	Harding/Ludlow	PR-3
Archaeological Site No. 39HN17	Harding/Ludlow	PR-3
Archaeological Site No. 39HN18	Harding/Ludlow	PR-3
Archaeological Site No. 39HN21	Harding/Ludlow	PR-3
Archaeological Site No. 39HN22	Harding/Ludlow	PR-3
Archaeological Site No. 39HN26	Harding/Ludlow	PR-3
Archaeological Site No. 39HN30	Harding/Ludlow	PR-3
Archaeological Site No. 39HN50	Harding/Ludlow	PR-3
Archaeological Site No. 39HN53	Harding/Ludlow	PR-3
Archaeological Site No. 39HN54	Harding/Ludlow	PR-3
Archaeological Site No. 39MD81*	Meade/Sturgis	Gateway West ATCAA
Archaeological Site No. 39MD82*	Meade/Sturgis	Gateway West ATCAA
Archaeological Site No. 39HN121	Harding/Ludlow	PR-3
Archaeological Site No. 39HN150	Harding/Ludlow	PR-3
Archaeological Site No. 39HN155	Harding/Ludlow	PR-3
Archaeological Site No. 39HN159	Harding/Ludlow	PR-3
Archaeological Site No. 39HN160	Harding/Ludlow	PR-3
Archaeological Site No. 39HN162	Harding/Ludlow	PR-3
Archaeological Site No. 39HN165	Harding/Ludlow	PR-3
Archaeological Site No. 39HN167	Harding/Ludlow	PR-3
Archaeological Site No. 39HN168	Harding/Ludlow	PR-3
Archaeological Site No. 39HN171	Harding/Ludlow	PR-3
Archaeological Site No. 39HN174	Harding/Ludlow	PR-3
Archaeological Site No. 39HN177	Harding/Ludlow	PR-3
Archaeological Site No. 39HN198	Harding/Ludlow	PR-3
Archaeological Site No. 39HN199	Harding/Ludlow	PR-3
Archaeological Site No. 39HN205	Harding/Ludlow	PR-3
Archaeological Site No. 39HN207	Harding/Ludlow	PR-3
Archaeological Site No. 39HN208	Harding/Ludlow	PR-3
Archaeological Site No. 39HN209	Harding/Ludlow	PR-3
Archaeological Site No. 39HN210	Harding/Ludlow	PR-3
Archaeological Site No. 39HN213	Harding/Ludlow	PR-3
Archaeological Site No. 39HN217	Harding/Ludlow	PR-3
Archaeological Site No. 39HN218	Harding/Ludlow	PR-3
Archaeological Site No. 39HN219	Harding/Ludlow	PR-3
Archaeological Site No. 39HN227	Harding/Ludlow	PR-3

<b>Table 3a. National Register Properties Under Proposed PRTC Airspace</b>		
<b>An * indicates that the property is located within the ATCAAs with altitudes from 18,000 feet MSL to 60,000 feet</b>		
<b>Property Name</b>	<b>General Location (County/Town)</b>	<b>Airspace</b>
Archaeological Site No. 39HN228	Harding/Ludlow	PR-3
Archaeological Site No. 39HN232	Harding/Ludlow	PR-3
Archaeological Site No. 39HN234	Harding/Ludlow	PR-3
Archaeological Site No. 39HN484	Harding/Ludlow	PR-3
Archaeological Site No. 39HN485	Harding/Ludlow	PR-3
Archaeological Site No. 39HN486	Harding/Ludlow	PR-3
Archaeological Site No. 39HN487	Harding/Ludlow	PR-3
Ashcroft, Thomas, Ranch	Harding/Bufalo	PR-2
Baker Bungalow*	Lawrence/Spearfish	Gateway West ATCAA
Bartlett, L. L., House*	Meade/Stoneville	Gateway East ATCAA
Bear Butte*	Meade/Sturgis	Gateway West ATCAA
Beckon, Donald, Ranch	Perkins/Zeona	Gateway East ATCAA
Belle Fourche Commercial District*	Butte/Belle Fourche	Gateway West ATCAA
Belle Fourche Dam*	Butte/Belle Fourche	Gateway West ATCAA
Belle Fourche Experiment Farm*	Butte/Newell	Gateway West ATCAA
Bethany United Methodist Church	Perkins/Lodgepole	PR-4
Blake Ranch House	Harding/Gustave	PR-2
Bolles, Charles, House*	Butte/Belle Fourche	Gateway West ATCAA
Butte County Courthouse and Historic Jail Building*	Butte/Belle Fourche	Gateway West ATCAA
Butte-Lawrence County Fairgrounds*	Butte/Nisland	Gateway West ATCAA
Carr No. 60 School	Perkins/Lodgepole	PR-4
Carr, Anna, Homestead	Perkins/Bison	PR-4
Cook, Fayette, House*	Lawrence/Spearfish	Gateway West ATCAA
Corbin, James A. House*	Lawrence/Spearfish	Gateway West ATCAA
Court, Henry, House*	Lawrence/Spearfish	Gateway West ATCAA
Dakota Club Library*	Dewey/Eagle Butte	Gateway East ATCAA
Dakota Tin and Gold Mine*	Lawrence/Spearfish	Gateway West ATCAA
Deadwood Historic District*	Lawrence/Deadwood	Gateway West ATCAA
Dickey, Eleazer C. and Winnie, House*	Lawrence/Spearfish	Gateway West ATCAA
Dickey, Walter, House*	Lawrence/Spearfish	Gateway West ATCAA
Ditchrider House*	Butte/Nisland	Gateway West ATCAA
Driskill, William D., House*	Lawrence/Spearfish	Gateway West ATCAA
Duck Creek Lutheran Church and Cemetery	Perkins/Lodgepole	PR-4
Emmanuel Lutheran Church and Cemetery	Harding/Ralph	PR-3
Episcopal Church of All Angels*	Lawrence/Spearfish	Gateway West ATCAA
Erskine School*	Meade/Sturgis	Gateway West ATCAA
Evans, Robert H., House*	Corson/	PR-4
Fort Manuel	Corson/ McIntosh	PR-4
Fort Meade District*	Meade/Sturgis	Gateway West ATCAA
Foster Ranch House	Perkins/Chance	PR-4
Fowler Hotel	Harding/Bufalo	PR-2
Frawley Historic Ranch*	Lawrence/Spearfish	Gateway West ATCAA
Frozenman Stage Station	Perkins/Bison	PR-4
Fruitdale School*	Butte/Fruitdale	Gateway West ATCAA
Fruitdale Store*	Butte/Fruitdale	Gateway West ATCAA
Galena School*	Lawrence/Lead	Gateway West ATCAA
Gartner, Carl Frederick, Homestead*	Butte/Newell	Gateway West ATCAA
Gay, Thomas Haskins, House*	Butte/Belle Fourche	Gateway West ATCAA
Giannonatti Ranch	Harding/Ludlow	PR-3
Golden Rule Department Store	Perkins/Lemmon	PR-4
Golden Valley Norwegian Church	Harding/Ralph	PR-3
Graf, Stephen and Maria, House*	Meade/Sturgis	Gateway West ATCAA
Halloran-Matthews-Brady House*	Lawrence/Spearfish	Gateway West ATCAA
Harriman, L. F., House	Perkins/Lemmon	PR-4
Harris, Fred S., House*	Butte/Belle Fourche	Gateway West ATCAA
Harvey, Jerome and Jonetta Homestead Cabin*	Lawrence/Lead	Gateway West ATCAA

<b>Table 3a. National Register Properties Under Proposed PRTC Airspace</b>		
<b>An * indicates that the property is located within the ATCAAs with altitudes from 18,000 feet MSL to 60,000 feet</b>		
<b>Property Name</b>	<b>General Location (County/Town)</b>	<b>Airspace</b>
Hay Creek Bridge*	Butte/Belle Fourche	Gateway West ATCAA
Hewes, Arthur, House*	Lawrence/Spearfish	Gateway West ATCAA
Homestake Workers House*	Lawrence/Spearfish	Gateway West ATCAA
Hoover, Alexander House*	Butte/Hoover	Gateway East ATCAA
Hoover Store*	Butte/Hoover	Gateway East ATCAA
Immanuel Lutheran Church*	Perkins/Zeona	Gateway East ATCAA
Jesse Elliott Ranger Station	Harding County	Gateway East ATCAA
Johnson, Axel, Ranch	Harding/Reva	Gap B MOA
Johnson, William, House*	Butte/Fruitdale	Gateway West ATCAA
Keets, Henry, House*	Lawrence/Spearfish	Gateway West ATCAA
Kenaston, William G., House*	Butte/Newell	Gateway West ATCAA
Knight, Webb, S., House*	Lawrence/Spearfish	Gateway West ATCAA
Kroll Meat Market and Slaughterhouse*	Lawrence/Spearfish	Gateway West ATCAA
Langdon School*	Butte/Nisland	Gateway West ATCAA
Lead Historic District	Lawrence/Lead	Gateway West ATCAA
Lemmon Petrified Park	Perkins/Lemmon	PR-4
Lemmon, G. E., House	Perkins/Lemmon	PR-4
Lightning Spring	Harding/Ludlow	PR-3
Lincoln School*	Butte/Belle Fourche	Gateway West ATCAA
Little Missouri Bank Building	Harding/Camp Crook	PR-2
Livingston, John and Daisy May, Ranch	Perkins/Sorum	Gateway East ATCAA
Lown, William Ernest, House*	Lawrence/Spearfish	Gateway West ATCAA
McLaughlin Ranch Barn*	Lawrence/Spearfish	Gateway West ATCAA
Minnesela Bridge*	Butte/Belle Fourche	Gateway West ATCAA
Mount Theodore Roosevelt Monument*	Lawrence/Deadwood	Gateway West ATCAA
Newell Depot Bridge*	Butte/Newell	Gateway West ATCAA
Newell High School*	Butte/Newell	Gateway West ATCAA
Nisland Bridge*	Butte/Nisland	Gateway West ATCAA
Old Finnish Lutheran Church*	Lawrence/Lead	Gateway West ATCAA
Old Redwater Bridge*	Lawrence/Spearfish	Gateway West ATCAA
Old Spearfish Post Office*	Lawrence/Spearfish	Gateway West ATCAA
Olson Bridge*	Butte/Belle Fourche	Gateway West ATCAA
Peace Valley Evangelical Church and Cemetery	Harding/Ralph	PR-3
Qullian, Thomas, House*	Lawrence/St. Onge	Gateway West ATCAA
Raskob, Jacob and Elizabeth Ranch*	Meade/Sturgis	Gateway West ATCAA
Richards Cabins*	Perkins/Faith	Gateway East ATCAA
Riley, Almira, House*	Lawrence/Spearfish	Gateway West ATCAA
Rockford No. 40 School	Perkins/Bison	PR-4
Scotney, John Aaron, House*	Butte/Belle Fourche	Gateway West ATCAA
Shevling, L. W., Ranch	Harding/Harding	PR-2
Sittner Farm	Perkins/Meadow	PR-4
Small, Charles and Eleanor House*	Butte/Belle Fourche	Gateway West ATCAA
Snoma Finnish Cemetery*	Butte/Fruitdale	Gateway West ATCAA
Soper-Behymer Ranch*	Butte/Belle Fourche	Gateway West ATCAA
Sorum Cooperative Store	Perkins/Sorum	Gateway East ATCAA
Sorum Hotel	Perkins/Sorum	Gateway East ATCAA
South Dakota Department of Transportation Bridge No. 10-109-360*	Butte/Belle Fourche	Gateway West ATCAA
South Dakota Department of Transportation Bridge No. 10-270-338*	Butte/Newell	Gateway West ATCAA
Spearfish City Hall*	Lawrence/Spearfish	Gateway West ATCAA
Spearfish Filling Station*	Lawrence/Spearfish	Gateway West ATCAA
Spearfish Fisheries Station*	Lawrence/Spearfish	Gateway West ATCAA
Spearfish Historic Commercial District*	Lawrence/Spearfish	Gateway West ATCAA
Spring Creek School*	Perkins/Zeona	Gateway East ATCAA
Stokes, Oliver O., House	Harding/Harding	PR-2
Stonelake Bridge*	Butte/Newell	Gateway West ATCAA
Stomprude Trail Ruts	Perkins/Bison	PR-4

<b>Table 3a. National Register Properties Under Proposed PRTC Airspace</b>		
An * indicates that the property is located within the ATCAAs with altitudes from 18,000 feet MSL to 60,000 feet		
<b>Property Name</b>	<b>General Location (County/Town)</b>	<b>Airspace</b>
Sturgis Commercial Block*	Meade/Sturgis	Gateway West ATCAA
Sturgis High School*	Meade/Sturgis	Gateway West ATCAA
St. Onge Schoolhouse*	Lawrence/St. Onge	Gateway West ATCAA
St. Onge State Bank*	Lawrence/St. Onge	Gateway West ATCAA
St. Lawrence O'Toole Catholic Church*	Lawrence/Central City	Gateway West ATCAA
Tallent, Annie, House*	Meade/Sturgis	Gateway West ATCAA
The Mail Building*	Lawrence/Spearfish	Gateway West ATCAA
Toomey House*	Lawrence/Spearfish	Gateway West ATCAA
Tri-State Bakery*	Butte/Belle Fourche	Gateway West ATCAA
Uhlig, Otto L., House*	Lawrence/Spearfish	Gateway West ATCAA
Vale Bridge*	Butte/Vale	Gateway West ATCAA
Vale Cut Off Belle Fourche River Bridge	Butte/Belle Fourche	Gateway West ATCAA
Vale School*	Butte/Vale	Gateway West ATCAA
Veal, Thomas J., Ranch	Perkins/Chance	PR-4
Vessey School	Harding/Haley	PR-3
Viken, Nicholas Augustus Homestead	Butte/Newell	Gateway West ATCAA
Walsh Barn*	Lawrence/Spearfish	Gateway West ATCAA
Walton Ranch*	Lawrence/Spearfish	Gateway West ATCAA
Wenke, John G., House*	Meade/Sturgis	Gateway West ATCAA
Whitewood Historic District*	Lawrence/Whitewood	Gateway West ATCAA
Whitney, Mary, House*	Lawrence/Spearfish	Gateway West ATCAA
Wide Awake Grocery Building*	Butte/Belle Fourche	Gateway West ATCAA
Wolzmuth, John, House*	Lawrence/Spearfish	Gateway West ATCAA
Woodmen Hall*	Lawrence/St. Onge	Gateway West ATCAA

<b>Table 3b. National Monuments Under Proposed PRTC Airspace</b>		
<b>Name</b>	<b>General Location</b>	<b>Airspace</b>
<b>Wyoming</b>		
Devils Tower	Devils Tower	Gateway West ATCAA
<b>Montana</b>		
Little Bighorn Battlefield	Garryowen	PR-1

<b>Table 3c. National Historic Landmarks Under Proposed PRTC Airspace</b>		
<b>Landmark Name</b>	<b>General Location</b>	<b>Airspace</b>
<b>Montana</b>		
Deer Medicine Rocks	Rosebud County	PR-1
Wolf Mountains Battlefield/Where Big Crow Walked Back and Forth	Birney, Rosebud County	PR-1
<b>South Dakota</b>		
Bear Butte	Sturgis	Gateway West ATCAA
Deadwood Historic District	Deadwood	Gateway West ATCAA
Frawley Ranch	Whitewood	Gateway West ATCAA

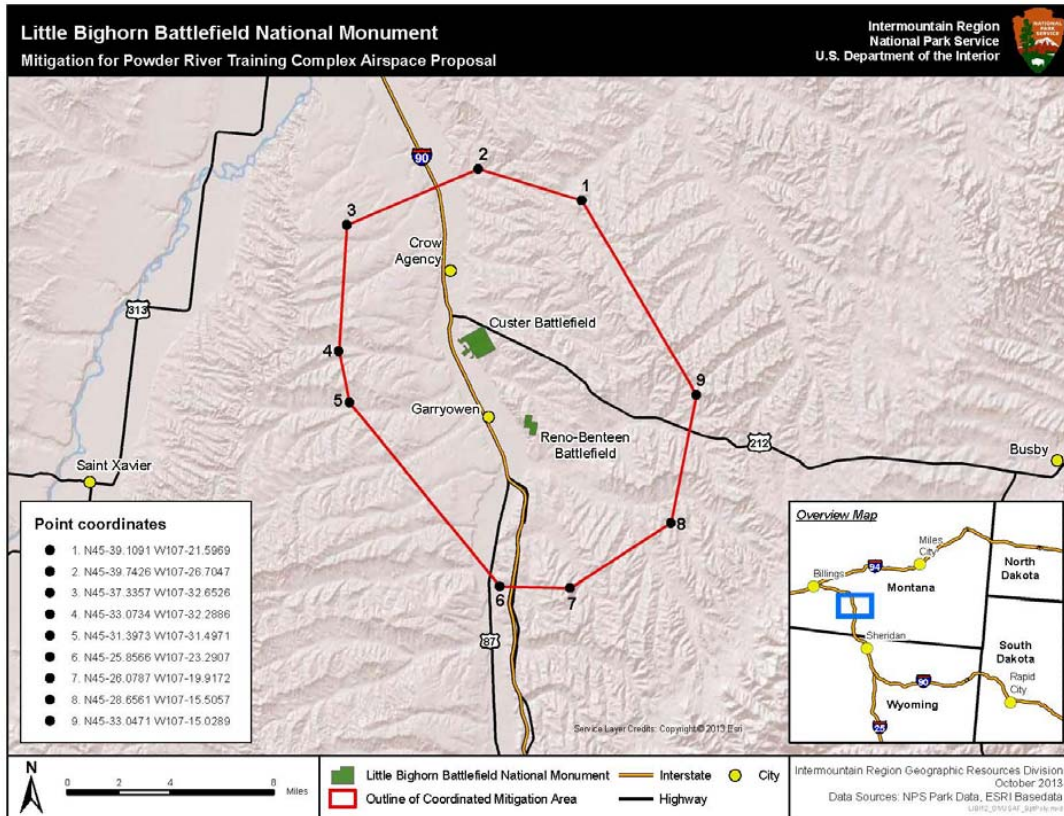
<b>Table 3d. Historic Ranches Under Proposed PRTC Airspace</b>			
<b>Name</b>	<b>General Location</b>	<b>Status</b>	<b>Airspace</b>
<b>Wyoming</b>			
Ranch A	Beulah	National Register Property	Gateway West
<b>Montana</b>			
Bones Brothers Ranch	Rosebud/Birney	National Register Property	PR-1

<b>Table 3d. Historic Ranches Under Proposed PRTC Airspace</b>			
Name	General Location	Status	Airspace
Cross Ranch Headquarters	Powder River/Broadus	National Register Property	PR-2
Drew, J. W., Grain Elevator	Big Horn/Lodge Grass	National Register Property	PR-1
Lee Homestead	Big Horn/Decker	National Register Property	PR-1
OW Ranch	Big Horn/Birney	National Register Property	PR-1
<b>North Dakota</b>			
H-T Ranch	Slope/Amidon	National Register Property	PR-3
<b>South Dakota</b>			
Ashcroft, Thomas, Ranch	Harding/Buffalo	National Register Property	Gap B MOA
Beckon, Donald, Ranch	Perkins/Zeona	National Register Property	Gateway East
Blake Ranch House	Harding/Gustave	National Register Property	PR-2
Carr, Anna, Homestead	Perkins/Bison	National Register Property	PR-4
Foster Ranch House	Perkins/Chance	National Register Property	PR-4
Frawley Ranch	Lawrence	National Historic Landmark	Gateway West
Gartner, Carl Frederick, Homestead	Butte/Newell	National Register Property	Gateway West ATCAA
Giannonatti Ranch	Harding/Ludlow	National Register Property	PR-3
Johnson, Axel, Ranch	Harding/Reva	National Register Property	Gap B MOA
Livingston, John and Daisy May, Ranch	Harding/Sorum	National Register Property	Gateway East ATCAA
McLaughlin Ranch Barn	Lawrence/Spearfish	National Register Property	Gateway West
Raskob, Jacob and Elizabeth Ranch	Meade/Sturgis	National Register Property	Gateway West ATCAA
Shevling, L.W., Ranch	Harding/Harding	National Register Property	PR-2
Soper-Behymer Ranch	Butte/Belle Fourche	National Register Property	Gateway West
Veal, Thomas J., Ranch	Perkins/Chance	National Register Property	PR-4
Viken, Nicholas Augustus Homestead	Butte/Newell	National Register Property	Gateway West ATCAA
Walsh Barn	Lawrence/Spearfish	National Register Property	Gateway West
Walton Ranch	Lawrence/Spearfish	National Register Property	Gateway West
William Holst Farmstead	Meade/Vale	South Dakota State Register Property	Gateway West ATCAA

<b>Table 3e. Traditional Cultural Properties Under Proposed PRTC Airspace</b>		
Area Name	General Location	Airspace
<b>Wyoming</b>		
Devils Tower National Monument	Devils Tower	Gateway West ATCAA
Inyan Kara Mountain	South of Sundance	Gateway West ATCAA
Unnamed 1	North of Gillette	Gateway West ATCAA
Unnamed 2	Northwest of Hulett	PR-2
<b>Montana</b>		
Chalk Buttes	Ekalaka	Gap B MOA
Wolf Mountains Battlefield/Where Big Crow Walked Back and Forth NHL	Tongue River	PR-1
<b>South Dakota</b>		
Bear Butte NHL	Sturgis	Gateway West ATCAA

Table 3f. Nominated Cultural Landscape Under Proposed PRTC Airspace in Montana		
Area Name	General Location	Airspace
Tongue River Valley	Ashland	PR-1

**Attachment 4: Map of the Little Bighorn Battlefield National Monument Area per Stipulation I.A.1.**



*PA Regarding Development, Implementation, and Operation of the Powder River Training Complex: 27 June 2014 Version*

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