APPENDIX A

THE AICUZ CONCEPT, PROGRAM, METHODOLOGIES AND POLICIES

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APPENDIX A. THE AICUZ CONCEPT, PROGRAM, METHODOLOGIES, AND POLICIES

A.1 CONCEPT

Federal legislation, national sentiment, and other external forces, which directly affect the U.S. Department of Defense (DoD) mission, serve greatly to increase the role of the DoD in environmental and planning issues. Problems of airfield and range encroachment from incompatible land uses surrounding installations, as well as air and water pollution and socioeconomic impact, require continued and intensified DoD involvement. The nature of these problems dictates direct DoD participation in comprehensive community and land use planning. Effective, coordinated planning that bridges the gap between the Federal Government and the community requires establishment of good working relationships with local citizens, local planning officials, and state and Federal officials. This depends on creating an atmosphere of mutual trust and helpfulness. The Air Installation Compatible Use Zone (AICUZ) concept has been developed in an effort to:

- Protect local citizens from noise exposure and accident potential associated with flying activities and
- Prevent degradation of the capability of DoD to achieve its mission by promoting compatible land use planning.

The land use guidelines developed herein are a composite of a number of other land use compatibility studies that have been refined to fit the Dyess Air Force Base (AFB) aviation environment.

A.2 PROGRAM

Installation commanders establish and maintain active programs to promote the maximum feasible land use compatibility between air installations and neighboring communities. The programs require that all appropriate government bodies and citizens be fully informed whenever AICUZ or other planning matters affecting the installation are under consideration. This includes positive and continuous programs designed to:

- Provide information, criteria, and guidelines to Federal, state, regional, and local planning bodies; civic associations; and similar groups;
- Inform such groups of the requirements of the flying activity, noise exposure, aircraft accident potential, and AICUZ plans;
- Describe the noise-level reduction (NLR) measures that are being used; and
- Ensure that all reasonable, economical, and practical measures are taken to reduce or control the impact of noise-producing activities. These measures include such considerations as proper location of engine test facilities, provision of sound suppressors where necessary, and adjustment of flight patterns and/or techniques to minimize the noise impact on populated areas. This must be done without jeopardizing safety or operational effectiveness.

A.3 METHOD

The AICUZ Program consists of land areas upon which certain land uses may obstruct the airspace or otherwise be hazardous to aircraft operations and land areas that are exposed to the health, safety, or welfare hazards of aircraft operations. The AICUZ Program includes:

- Accident Potential Zones (APZs) and Clear Zones (CZs) based on past U.S. Air Force (USAF) aircraft accidents and installation operational data (see Appendix C);
- Noise zones produced by the computerized modeling of the noise created by aircraft operations and munitions training (see Section 3.1.1 of this AICUZ Study); and
- The area designated by the Federal Aviation Administration and the USAF for purposes of height limitations in the approach and departure zones of the base (see Section 3.1.4 of this AICUZ Study).

The APZ, CZ, and noise zone are the basic building blocks for land use planning with AICUZ data. Compatible land uses are specified for these zones (see Table 3–1 in Section 3 of this AICUZ Study), and recommendations on building materials and standards to reduce interior noise levels inside structures are provided in Appendix E.

According to DoD policy, ownership in fee or of an appropriate restrictive use easement within the CZ is preferred, unless state and local government development regulations will clearly have long-term effectiveness. Dyess AFB either owns or holds restrictive easements on most of the property in the CZs (see Section 3 of this AICUZ Study). Compatible land use controls for the remaining airfield area of influence should be accomplished through the community land use planning processes.

A.4 AICUZ LAND USE DEVELOPMENT POLICIES

The basis for any effective land use control system is the development of, and subsequent adherence to, policies that serve as the standard by which all land use planning and control actions are evaluated. Dyess AFB recommends the following policies be considered for incorporation into the comprehensive plans of agencies in the vicinity of the installation's area of influence.

A.4.1 Policy 1

To promote the public health, safety, peace, comfort, convenience, and general welfare of the inhabitants in the airfield area of influence, it is necessary to:

- Guide, control, and regulate future growth and development;
- Promote orderly and appropriate use of land;
- Protect the character and stability of existing land uses;
- Prevent destruction or impairment of the airfield and the public investment therein;
- Enhance the quality of living in the areas affected; and
- Protect the general economic welfare by restricting incompatible land use.

A.4.2 Policy 2

In furtherance of Policy 1, it is appropriate to:

- Establish guidelines of land use compatibility;
- Restrict or prohibit incompatible land use;
- Prevent establishment of any land use that would unreasonably endanger aircraft operations and the continued use of the airfield;
- Incorporate the AICUZ concept into community land use plans, modifying them when necessary; and
- Adopt appropriate ordinances to implement airfield area of influence land use plans.

A.4.3 Policy 3

Within the boundaries of the CZ, certain land uses are inherently incompatible. The following land uses are not in the public interest and must be restricted or prohibited:

- Uses that release into the air any substance, such as steam, dust, or smoke, that would impair visibility or otherwise interfere with the operation of aircraft;
- Uses that produce light emissions, either direct or indirect (reflective), that would interfere with pilot vision;
- Uses that produce electrical emissions that would interfere with aircraft communication systems or navigation equipment;
- Uses that attract birds or waterfowl, such as operation of sanitary landfills, maintenance or feeding stations, or growth of certain vegetation; and
- Uses that provide for structures within 10 feet of aircraft approach-departure and/or transitional surfaces.

A.4.4 Policy 4

Certain noise levels of varying duration and frequency create hazards to both physical and mental health. A limited, though definite, danger to life exists in certain areas adjacent to airfields. Where these conditions are sufficiently severe, it is not consistent with public health, safety, and welfare to allow the following land uses:

- Residential
- Retail business
- Office buildings
- Public buildings (schools, churches, etc.)
- Recreation buildings and structures

A.4.5 Policy 5

Land areas below takeoff and final approach flight paths are exposed to significant danger of aircraft accidents. The density of development and intensity of use must be limited in such areas.

A.4.6 Policy 6

Different land uses have different sensitivities to noise. Standards of land use acceptability should be adopted, based on these noise sensitivities. In addition, a system of NLR guidelines (see Appendix E) for new construction should be implemented to permit certain uses where they would otherwise be prohibited.

A.4.7 Policy 7

Land use planning and zoning in the airfield area of influence cannot be based solely on aircraft-generated effects. Allocation of land used within the AICUZ guidelines should be further refined by consideration of:

- Physiographic factors
- Climate and hydrology
- Vegetation
- Surface geology
- Soil characteristics
- Intrinsic land use capabilities and constraints
- Existing land use
- Land ownership patterns and values
- Economic and social demands
- Cost and availability of public utilities, transportation, and community facilities
- Other noise sources

A.5 BASIC LAND USE COMPATIBILITY

Research on aircraft accident potential, noise, and land use compatibility is ongoing at a number of Federal and other agencies. These and all other compatibility guidelines must not be considered inflexible standards. They are the framework within which land use compatibility questions can be addressed and resolved. In each case, full consideration must be given to local conditions such as:

- Previous community experience with aircraft accidents and noise
- Local building construction and development practices
- Existing noise environment due to other urban or transportation noise sources

- Time periods of aircraft operations, munitions training, and land use activities
- Specific site analysis
- Noise buffers, including vegetation

These basic guidelines cannot resolve all land use compatibility questions, but they do offer a reasonable framework within which to work.

A.6 ACCIDENT POTENTIAL

Land use guidelines for the Class B runway CZs and APZs are based on a Hazard Index system that compares the relationship of accident occurrence for five areas:

- On or adjacent to the runway
- Within the CZ
- In APZ I
- In APZ II
- In all other areas within a 10-nautical-mile radius of the runway

Accident potential on or adjacent to the runway or within the CZ is so high that few uses are recommended. The risk outside APZ I and APZ II, but within the 10-nautical-mile radius area, is significant, but is acceptable if sound engineering and planning practices are followed.

Land use guidelines for APZs I and II have been developed. The main objective has been to restrict all people-intensive uses because there is greater risk in these areas. The basic guidelines aim at prevention of uses that:

- Have high residential density characteristics;
- Have high labor intensity;
- Involve aboveground explosives, fire, toxic, corrosive, or other hazardous characteristics;
- Promote population concentrations;
- Involve utilities and services required for area-wide population, where disruption would have an adverse impact (telephone, gas, etc.);
- Concentrate people who are unable to respond to emergency situations, such as children, elderly, disabled, etc.; and
- Pose hazards to aircraft operations.

There is no question that these guidelines are relative. Ideally, there should be no people-intensive uses in either of these APZs. The free market and private property systems prevent this where there is a demand for land development. To go beyond these guidelines, however, substantially increases risk by placing more people in areas where there may ultimately be an aircraft accident.

A.7 NOISE

Nearly all studies analyzing aircraft noise and residential compatibility recommend no residential uses in noise zones above 75 decibels (dB) day–night average sound level (DNL). Usually, no restrictions are recommended below the 65 dB-DNL noise zone. There is currently no consensus on areas with noise levels of 65–74 dB-DNL. These areas may not qualify for Federal mortgage insurance in residential categories according to U.S. Department of Housing and Urban Development (HUD) noise regulations found in Title 24 of the *Code of Federal Regulations*, Part 51B. In many cases, HUD approval requires noise attenuation measures, the Regional Administrator's concurrence, and an environmental impact statement. The U.S. Department of Veterans Affairs also has airfield noise and accident restrictions that apply to its home loan guarantee program. Whenever possible, residential land use should be located in areas with noise levels below 65 dB-DNL according to USAF land use recommendations. Residential buildings within the 65–74 dB-DNL noise contour should contain NLR in accordance with the USAF land use compatibility guidelines in the 2015 Dyess AFB AICUZ Study (see Table 3–1).

Most industrial/manufacturing uses are compatible in the airfield area of influence. Exceptions are uses such as research or scientific activities that require lower noise levels. Noise attenuation measures are recommended for portions of buildings devoted to office use, receiving the public, or where the normal background noise level is low.

The transportation, communications, and utilities categories have a high noise level compatibility because they generally are not people-intensive. When people use land for these purposes, the use is generally very short in duration. Where buildings are required for these uses, additional evaluation is warranted.

The commercial/retail trade and personal and business services categories are compatible without restriction up to noise levels of 70 dB-DNL; however, they are generally incompatible above 80 dB-DNL. Between 70 and 79 dB-DNL, NLR measures should be included in the design and construction of buildings.

The nature of most uses in the public and quasi-public services category requires a quieter environment, and attempts should be made to locate these uses in areas with noise levels below 65 dB-DNL (a USAF land use recommendation), or else provide adequate NLR.

Although recreational use has often been recommended as compatible with high noise levels, recent research has resulted in a more conservative view. Above 75 dB-DNL, noise becomes a factor that limits the ability to enjoy such uses. Where the requirement to hear is a function of the use (e.g., music shell), compatibility is limited. Buildings associated with golf courses and similar uses should be noise attenuated.

With the exception of forestry activities and livestock farming, uses in the resources production, extraction, and open space category are compatible almost without restrictions.

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APPENDIX B

NOISE

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APPENDIX B. NOISE

B.1 NOISE METRICS

There are many types of sound, and several different metrics can be used to quantify different types. Sound intensity is typically described using decibels (dB). The threshold of human hearing is approximately 0 dB, and the threshold of pain is approximately 140 dB.

The human ear can normally hear frequencies from about 20 Hertz (Hz) to about 20,000 Hz. It is most sensitive to sounds in the 1,000 to 4,000 Hz range. Many measurements of sound levels are adjusted so that component frequencies that are best heard by the human ear are emphasized. This process, known as "A-weighting," can be assumed to be applied to all sound levels in this report unless otherwise specified.

The day–night average sound level (DNL) noise metric describes the average noise level over the course of a 24-hour period. It accounts for both the noise levels of individual events and the number of times those events occur. A 10 dB penalty is applied to operations that happen during acoustical night (10:00 p.m. through 7:00 a.m.) because noise tends to be more intrusive at night than during the day. Time-averaged noise levels, such as DNL, are useful for expressing overall noise levels at a location. DNL is the preferred noise metric of the Federal Aviation Administration, U.S. Department of Housing and Urban Development, U.S. Environmental Protection Agency, and U.S. Department of Defense (DoD) for determining land use compatibility in the airport environment.

It is important to recognize that DNL is not the sound level heard at any given time, but rather an average of noise levels that fluctuate over time. Each type of aircraft and each type of maneuver generates its own sound signature. Furthermore, the sound generated by aircraft typically changes over the course of an event. The DNL metric allows summarization of the overall noise level with a single number.

B.2 DAY–NIGHT AVERAGE SOUND LEVEL (DNL) TIME-AVERAGED NOISE ENVIRONMENT DESCRIPTOR

The noise contour methodology used herein is the DNL metric of describing the noise environment. Efforts to provide a national uniform standard for noise assessment have resulted in adoption by the U.S. Environmental Protection Agency of DNL as the standard noise descriptor for use in land use planning.

The DNL metric can be used to describe different types of sounds. Because human hearing picks up noise energy in certain frequency ranges better than others, sound energy in certain frequency bands is emphasized when measuring noise to best predict effects. For aircraft noise and most other types of sound, the frequencies most easily audible to humans are emphasized using a function known as A-weighting. Because A-weighting is very prevalent, sounds can be assumed to be A-weighted unless otherwise specified. Large munitions firing and detonation noise create low-frequency sound energy that is of particular concern because it can be felt as well as heard and can cause vibrations in nearby objects. The sounds may be expressed as C-weighted noise levels, which de-emphasize low-frequency sound energy to a lesser extent than A-weighting, or as un-weighted sound levels. Aircraft noise environments are generally described using A-weighted day–night average sound level (ADNL or DNL), while munitions noise is described using C-weighted day–night average sound level (CDNL).

The U.S. Air Force (USAF) uses the DNL descriptor in assessing the amount of aircraft noise exposure, and as a metric for community response to the various levels of exposure. The DNL values used for planning purposes are 65, 70, 75, and 80 dB. Land use guidelines are based on the compatibility of various land uses with these noise exposure levels. It is generally recognized that a noise environment descriptor should consider, in addition to the annoyance of a single event, the effect of repetition of such events and the time of day in which these events occur. DNL begins with a single-event descriptor and adds corrections for the number of events and the time of day. Since the primary development concern is residential, nighttime events are considered more annoying than daytime events and are weighted accordingly. DNL values are computed from the single-event noise descriptor, plus corrections for number of flights and time of day (see Figure B–1).

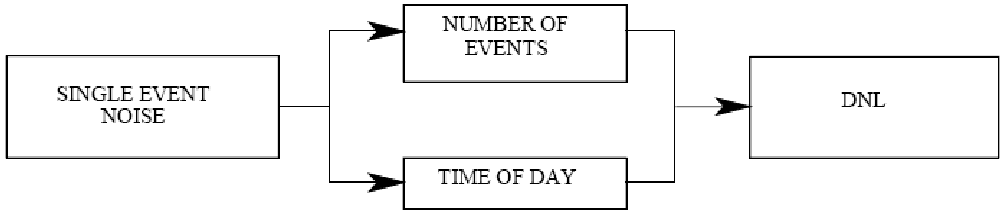

Figure B–1 Day–Night Average A-Weighted Sound Level

As part of the extensive data collection process, detailed information is gathered on the type of aircraft, the number, and time of day of flying operations for each flight track during a typical day. This information is used in conjunction with the single-event noise descriptor to produce DNL values. These values are combined on an energy summation basis to provide single DNL values for the mix of aircraft operations at the base. Equal value points are connected to form the contour lines.

B.3 SOUND EXPOSURE LEVEL (SEL) NOISE EVENT DESCRIPTOR

The single-event noise descriptor used in the DNL system is the sound exposure level (SEL). The SEL measure is an integration of an A-weighted noise level over the period of a single event such as an aircraft flyover, in decibels.

Frequency, magnitude, and duration vary according to aircraft type, engine type, and power setting. Therefore, individual aircraft noise data is collected for various types of aircraft/engines at different power settings and phases of flight. Figure B–2 shows the relationship of the single-event noise descriptor (SEL) to the source sound energy.

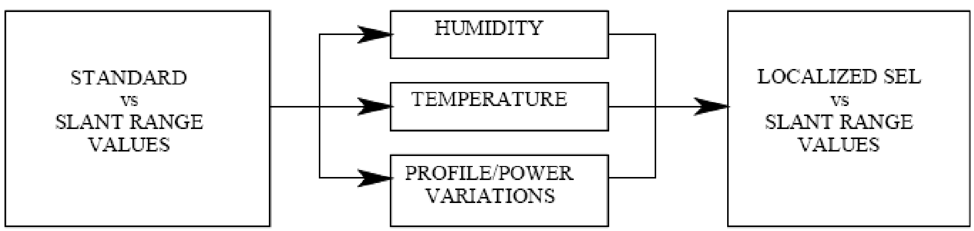

Figure B–2 Sound Exposure Level

SEL versus slant range values are derived from noise measurements made according to a source noise data acquisition plan developed by Bolt, Beranek, and Newman, Inc., in conjunction with the USAF's Armstrong Laboratory (AL) and carried out by AL. These standard day, sea level values form the basis for the single-event noise descriptors at any location and are adjusted to the location by applying appropriate corrections for temperature, humidity, and variations from standard profiles and power settings.

Ground-to-ground sound propagation characteristics are used for altitudes up to 500 feet absolute with linear transition between 500 and 700 feet and air-to-ground propagation characteristics above 700 feet.

In addition to the assessment of aircraft flight operations, the DNL system also incorporates noise resulting from engine/aircraft maintenance checks on the ground. Data concerning the orientation of the noise source, type of aircraft or engine, number of test runs on a typical day, power settings used and their duration, and use of suppression devices is collected for each ground run-up or test position. This information is processed and the noise contribution added (on an energy summation basis) to the noise generated by flying operations to produce noise contours reflecting the overall noise environment with respect to aircraft air and ground operations.

B.4 MAXIMUM NOISE LEVEL (L_{MAX}) NOISE EVENT DESCRIPTOR

The maximum noise level (L_{max}) noise metric describes the loudest point during a noise event, such as an aircraft flyover. This noise metric is useful because it is intuitively understood. All maximum noise levels listed in this Air Installation Compatible Use Zone (AICUZ) Study are in A-weighted decibels.

B.5 COMPUTER NOISE MODELS

Data describing flight track distances and turns, altitudes, airspeeds, power settings, flight track operational utilization, maintenance locations, ground run-up engine power settings, and number and duration of runs by type of aircraft/engine is assembled. Trained personnel process the data for input into the NOISEMAP computer program. Aircraft operations parameters are reviewed for accuracy by operational unit points of contact prior to running the noise model.

B.6 TECHNICAL INFORMATION

Additional technical information on the DNL procedures is available in the following publications:

- Community Noise Exposure Resulting from Aircraft Operations: Applications Guide for Predictive Procedure, AMRLTR-73-105, November, 1974, from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151.
- Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with Adequate Margin of Safety, U.S. Environmental Protection Agency Report 550/9-74-004, March, 1974, from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

B.7 CLIMATOLOGICAL DATA

Weather conditions, measured by temperature, relative humidity, and air pressure, are an important factor in the propagation of noise. The average temperature, humidity, and air pressure for each month of the year are an input to the NOISEMAP suite of programs, which then calculates the sound absorption coefficient for each month. Ranking the 12 monthly sound absorption coefficients from smallest to largest, BASEOPS chooses the sixth smallest sound absorption coefficient to represent the typical weather conditions at the base. The month with the sixth smallest sound absorption coefficient for Dyess AFB is the month with an average annual temperature of 66 degrees Fahrenheit, 60 percent relative humidity, and 28.14 inches of mercury.

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APPENDIX C

ACCIDENT POTENTIAL ZONES

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APPENDIX C. ACCIDENT POTENTIAL ZONES

C.1 GUIDELINES FOR ACCIDENT POTENTIAL

Areas around airports are exposed to the possibility of aircraft accidents even with well-maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, history makes it clear that accidents do happen.

When the Air Installation Compatible Use Zone (AICUZ) Program began, there were no current comprehensive studies on accident potential. To support the program, the U.S. Air Force (USAF) completed a study of USAF aircraft accidents that occurred between 1968 and 1972 within 10 nautical miles of airfields. The study of 369 accidents revealed that 75 percent of aircraft accidents occurred on or adjacent to the runway (1,000 feet to each side of the runway centerline) and in a corridor 3,000 feet wide (1,500 feet to either side of the runway centerline), extending from the runway threshold along the extended runway centerline for a distance of 15,000 feet. The USAF updated these studies and this information is presented later in this section.

The Clear Zone (CZ), Accident Potential Zone (APZ) I, and APZ II were established based on crash patterns. The CZ starts at the end of the runway and extends outward 3,000 feet. It has the highest accident potential of the three zones. The USAF adopted a policy of acquiring property rights to areas designated as CZs because of the high accident potential. APZ I extends from the CZ an additional 5,000 feet. It includes an area of reduced accident potential. APZ II extends from APZ I an additional 7,000 feet in an area of further reduced accident potential. Please note that the CZ and APZ for a Landing Zone are designed based on different criteria.

Research in accident potential conducted by the USAF was the first significant effort in this subject area since 1952, when the President's Airport Commission published "The Airport and Its Neighbors," better known as the "Doolittle Report." The recommendations of this early report were influential in the formulation of the APZ concept.

The risk to people on the ground being killed or injured by aircraft accidents is small. However, an aircraft accident is a high-consequence event, and when a crash does occur, the result is often catastrophic. Because of this, the USAF does not attempt to base its safety standards on accident probabilities. Instead, the USAF approaches this safety issue from a land use planning perspective.

C.2 ACCIDENT POTENTIAL ANALYSIS

Military aircraft accidents differ from commercial air carrier and general aviation accidents because of the variety of aircraft used, the type of missions, and the number of training flights. In 1973, the USAF performed a service-wide aircraft accident hazard study to identify land near airfields with significant accident potential. Accidents studied occurred within 10 nautical miles of airfields.

The study reviewed 369 major USAF accidents from 1968–1972 and found that 61 percent of those accidents were related to landing operations and 39 percent to takeoffs. It also found that 70 percent occurred in daylight and that fighter and training aircraft accounted for 80 percent of the accidents.

Because the purpose of the study was to identify accident hazards, the study plotted each of the 369 accidents in relation to the airfield. This plotting found that the accidents clustered along the runway and its extended centerline. To further refine this clustering, a tabulation was prepared that described the cumulative frequency of accidents as a function of distance from the runway centerline along the extended centerline. This analysis was done for widths of 2,000, 3,000, and 4,000 total feet. Table C–1 reflects the accident location analysis.

Table C–1 Accident Location Analysis (1968–1972)

Length From Both Ends of Runway (feet)	Width of Runway Extension (feet)		
	2,000	3,000	4,000
Percentage of Accidents			
On or Adjacent to Runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000	35	39	39
3,000 to 8,000	8	8	8
8,000 to 15,000	5	5	7
Cumulative Percentage of Accidents			
On or Adjacent to Runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000	58	62	62
3,000 to 8,000	66	70	70
8,000 to 15,000	71	75	77

Figure C–1 indicates that the cumulative number of accidents rises rapidly from the end of the runway to 3,000 feet, rises more gradually to 8,000 feet, and then continues at about the same rate of increase to 15,000 feet, where it levels off rapidly. The accident location analysis also indicates 3,000 feet as the optimum runway extension width and the width that includes the maximum percentage of accidents in the smallest area.

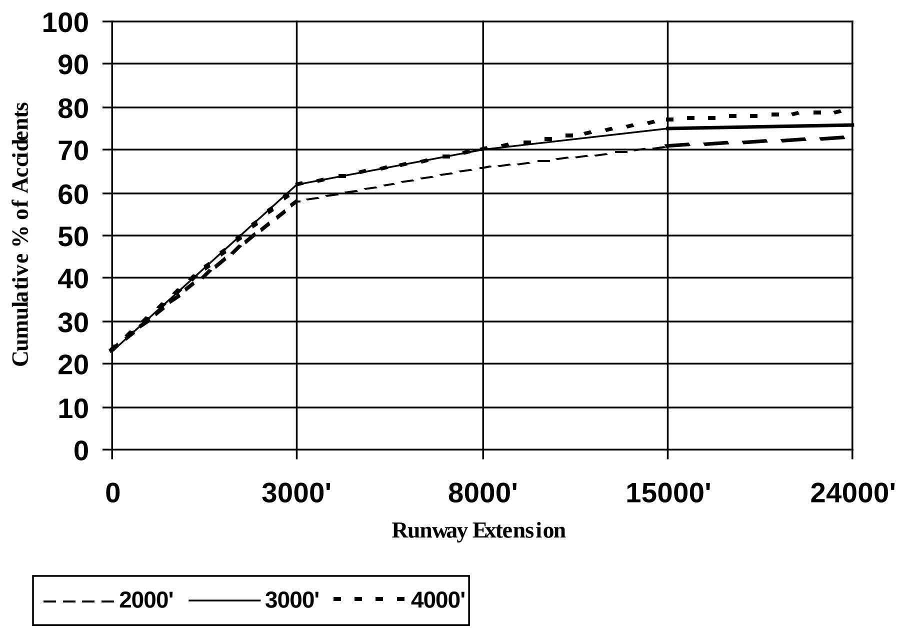

Figure C–1 Distribution of U.S. Air Force Aircraft Accidents (369 Accidents, 1968–1972)

Using the optimum runway extension width of 3,000 feet and the cumulative distribution of accidents from the end of the runway, zones were established that minimized the land area included and maximized the percentage of accidents included. The zone dimensions and accident statistics for the 1968–1972 study are shown in Figure C–2.

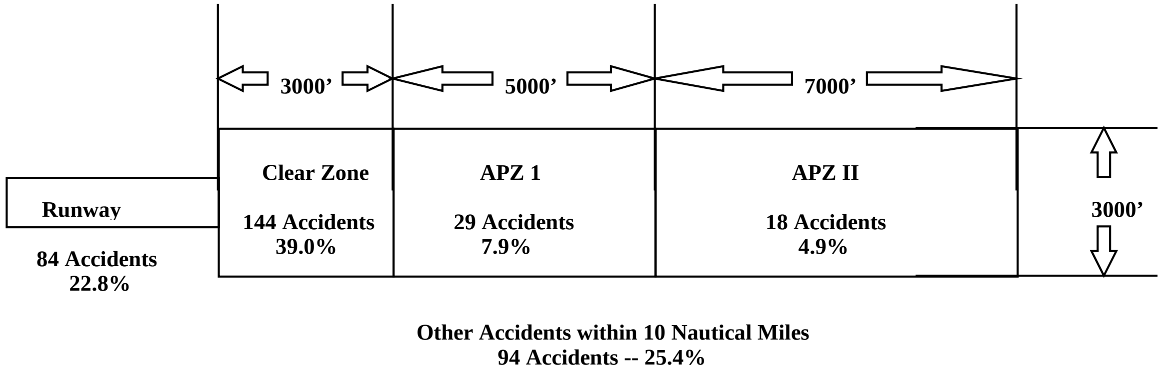

Figure C–2 U.S. Air Force Aircraft Accident Data
(369 Accidents, 1968–1972)

The original study was updated to include accidents through September 1995. This updated study includes 838 accidents during the 1968–1995 period. Using the optimum runway extension width of 3,000 feet, the accident statistics of the updated study are shown in Figure C–3.

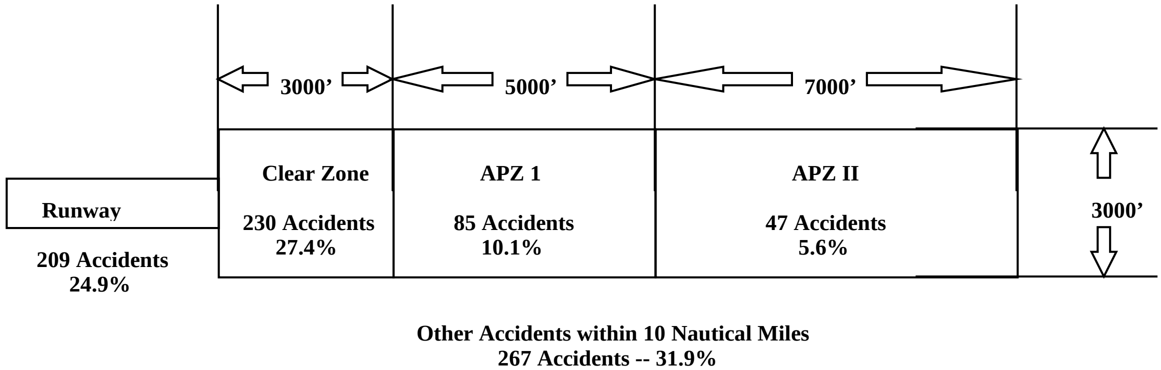

Figure C–3 U.S. Air Force Aircraft Accident Data
(838 Accidents, 1968–1995)

Using the designated zones and accident data, it is possible to calculate a ratio of percentage of accidents to percentage of area size. These ratios indicate the CZ, with the smallest area size and the highest number of accidents, has the highest ratio, followed by the runway and adjacent area, APZ I, and then APZ II. Table C–2 reflects this data. Analysis shows that the cumulative changes evident in accident location through July 1995 reconfirm the dimensions of the CZs and APZs.

Table C–2 Ratio of Percentage of Accidents to Percentage of Area (U.S. Air Force Accident Data, 1968–1995)

Zone	Area[1] (Acres)	Number[2] of Accidents	Accident Per Acre	Percentage of Total Area	Percentage of Total Accidents	Ratio:[3] % Accidents to % Area
Runway Area	487	209	1 Per 2.3 acres	0.183	24.9	136
Clear Zone	413	230	1 Per 1.8 acres	0.155	27.4	177
APZ I	689	85	1 Per 8.1 acres	0.258	10.1	39
APZ II	964	47	1 Per 20.5 acres	0.362	5.6	16
Other Area	264,053	267	1 Per 989 acres	99.042	31.9	0.3

[1] Area includes land within 10 nautical miles of runway.

[2] Total number of accidents is 838 (through 1995).

[3] Percentage total accidents divided by percentage total area

C.3 DEFINABLE DEBRIS IMPACT AREAS

The USAF also determined which accidents had definable debris impact areas, and in what phase of flight the accident occurred. Overall, 75 percent of the accidents had definable debris impact areas, although they varied in size by type of accident. The USAF used weighted averages of impact areas for accidents occurring only in the approach and departure phase to determine the following average impact areas:

Average Impact Areas for Approach and Departure Accidents

- Overall Average Impact Area: 5.06 acres
- Fighter, Trainer, and Miscellaneous Aircraft: 2.73 acres
- Heavy Bomber and Tanker Aircraft: 8.73 acres

C.4 FINDINGS

Designation of safety zones around the airfield and restriction of incompatible land uses can reduce the public's exposure to safety hazards.

USAF accident studies have found that aircraft accidents near USAF installations occurred in the following patterns:

- 61 percent were related to landing operations.
- 39 percent were related to takeoff operations.
- 70 percent occurred in daylight.
- 80 percent were related to fighter and training aircraft operations.
- 25 percent occurred on the runway or within an area extending 1,000 feet out from each side of the runway.
- 27 percent occurred in an area extending from the end of the runway to 3,000 feet along the extended centerline and 3,000 feet wide, centered on the extended centerline.

- 15 percent occurred in an area between 3,000 and 15,000 feet along the extended runway centerline and 3,000 feet wide, centered on the extended centerline.

USAF aircraft accident statistics found 75 percent of aircraft accidents resulted in definable debris impact areas. The size of the impact areas were:

- 5.06 acres overall average.
- 2.73 acres for fighters and trainers.
- 8.73 acres for heavy bombers and tankers.

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APPENDIX D

HEIGHT AND OBSTRUCTION CRITERIA

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APPENDIX D. HEIGHT AND OBSTRUCTION CRITERIA

D.1 GENERAL

This section establishes criteria for determining whether an object or structure is an obstruction to air navigation.

Obstructions to air navigation are considered to be natural objects or man-made structures that protrude above the planes or surfaces as defined in the following paragraphs and/or man-made objects that extend more than 500 feet above the ground at the site of the structure.

D.2 EXPLANATION OF TERMS

The following will apply (see Figure D–1):

Controlling Elevation. Whenever surfaces or planes within the obstructions criteria overlap, the controlling (or governing) elevation becomes that of the lowest surface or plane.

Runway Length. Dyess Air Force Base (AFB) has one bi-directional primary runway (Runway 16/34), and 13,500 feet of pavement designed and built for sustained aircraft landings and takeoffs.

Established Airfield Elevation. The elevation, in feet above mean sea level, for Dyess AFB is 1,788 feet.

Dimensions. All dimensions are measured horizontally unless otherwise noted.

D.3 PLANES AND SURFACES

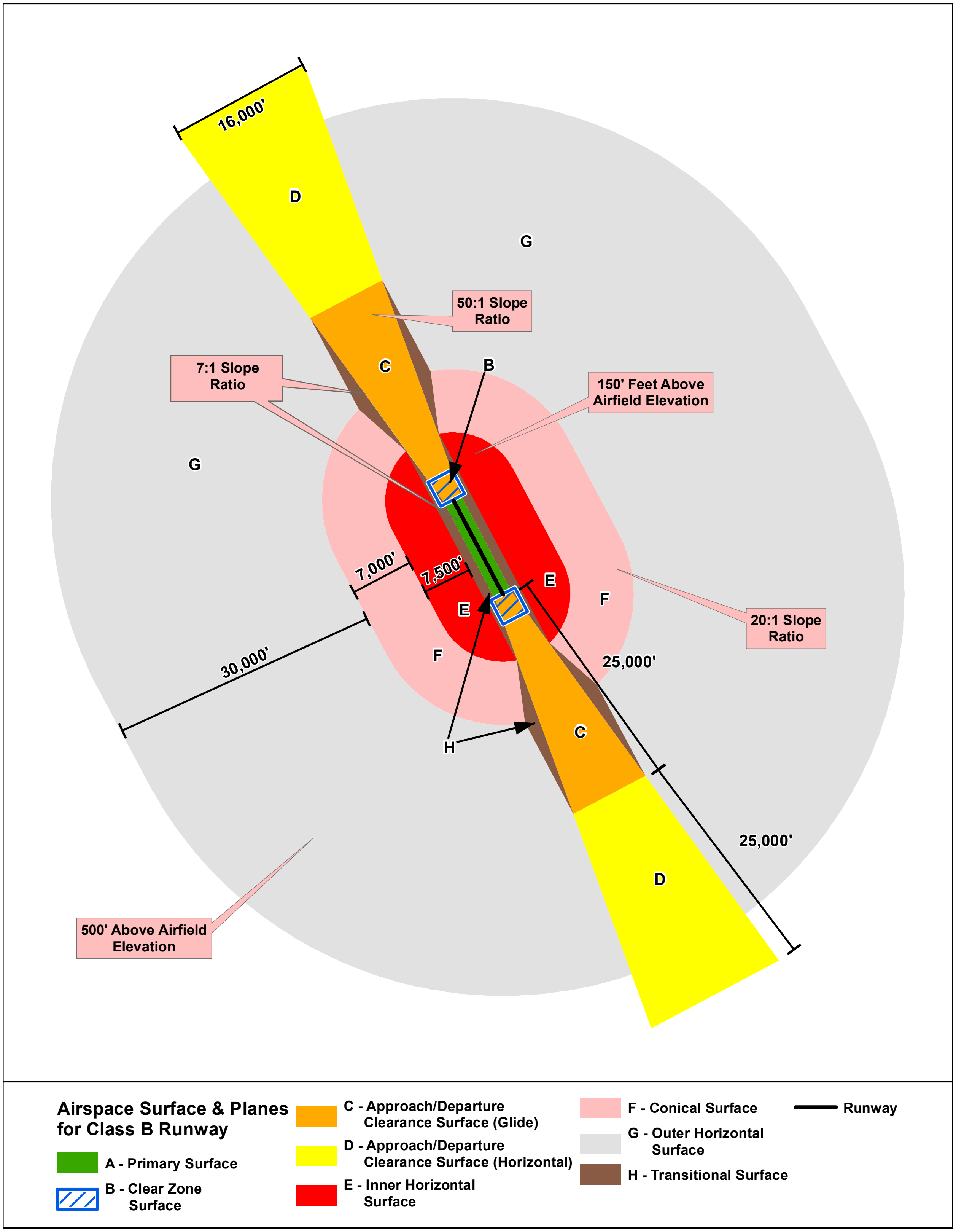
Definitions are as follows: (see Figures D–1, D–2, and D–3)

Primary Surface. This surface defines the limits of the obstruction clearance requirements in the immediate vicinity of the landing area. The primary surface comprises surfaces of the runway, runway shoulders, and lateral safety zones and extends 200 feet beyond the runway end. The width of the primary surface for a single class “B” runway is 2,000 feet, or 1,000 feet on each side of the runway centerline. For a Landing Zone (LZ), the primary surface begins at the end of the runway, extends to the Clear Zone (CZ), and is 180 feet wide.

Clear Zone Surface. This surface defines the limits of the obstruction clearance requirements in the vicinity contiguous to the end of the primary surface. The length and width (for a single runway) of a CZ surface at Runway 16/34 at Dyess AFB is 3,000 feet by 3,000 feet. For an LZ, the CZ begins at the end of the runway and is 500 feet long. The CZ is trapezoidal-shaped, beginning at 320 feet wide and fanning out to 500 feet wide.

Approach-Departure Clearance Surface. This surface is symmetrical about the runway centerline extended, begins as an inclined plane (glide angle) 200 feet beyond each end of the primary surface of the centerline elevation of the runway end, and extends for 50,000 feet. The slope of the approach-departure clearance surface is 50:1 along the extended runway (glide angle) centerline until it reaches an elevation of 500 feet above the established airfield elevation. It then continues horizontally at this elevation to a point 50,000 feet from the start of the glide angle. The width of this surface at the runway end is 2,000 feet; it flares uniformly, and the width at 50,000 feet is 16,000 feet. For an LZ, the approach-departure clearance surface starts at the end of the primary surface and slopes upward with a 20:1 slope. The slope length is 10,500 feet, with a width of 500 feet at the beginning of the slope and a width of 2,500 feet at the 10,500-foot mark.

Inner Horizontal Surface. This surface is a plane, oval in shape at a height of 150 feet above the established airfield elevation. It is constructed by scribing an arc with a radius of 7,500 feet above the centerline at the end of the runway and interconnecting these arcs with tangents.



Source of Airspace & Planes: Federal Aviation Administration Regulation Part 77, Subpart C.

Figure D–1 Airspace Control Surface Plan

Conical Surface. This is an inclined surface extending outward and upward from the outer periphery of the inner horizontal surface for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation. The slope of the conical surface is 20:1.

Outer Horizontal Surface. This surface is a plane located 500 feet above the established airfield elevation. It extends for a horizontal distance of 30,000 feet from the outer periphery of the conical surface.

Transitional Surfaces. These surfaces connect the primary surfaces, CZ surfaces, and approach-departure clearance surfaces to the outer horizontal surface, conical surface, other horizontal surface, or other transitional surfaces. The slope of the transitional surface is 7:1 outward and upward at right angles to the runway centerline. To determine the elevation for the beginning of the transitional surface slope at any point along the lateral boundary of the primary surface, including the CZ, draw a line from this point to the runway centerline. This line will be at right angles to the runway axis. The elevation at the runway centerline is the elevation for the beginning of the 7:1 slope.

The land areas outlined by these criteria should be regulated to prevent uses that might otherwise be hazardous to aircraft operations. The following uses should be restricted and/or prohibited:

- Uses that release into the air any substance that would impair visibility or otherwise interfere with the operation of aircraft (i.e., steam, dust, or smoke)
- Uses that produce light emissions, either direct or indirect (reflective), that would interfere with pilot vision
- Uses that produce electrical emissions that would interfere with aircraft communications systems or navigational equipment
- Uses that would attract birds or waterfowl, including but not limited to, operation of sanitary landfills, maintenance of feeding stations, or the growing of certain vegetation
- Uses that provide for structures within 10 feet of aircraft approach-departure and/or transitional surfaces

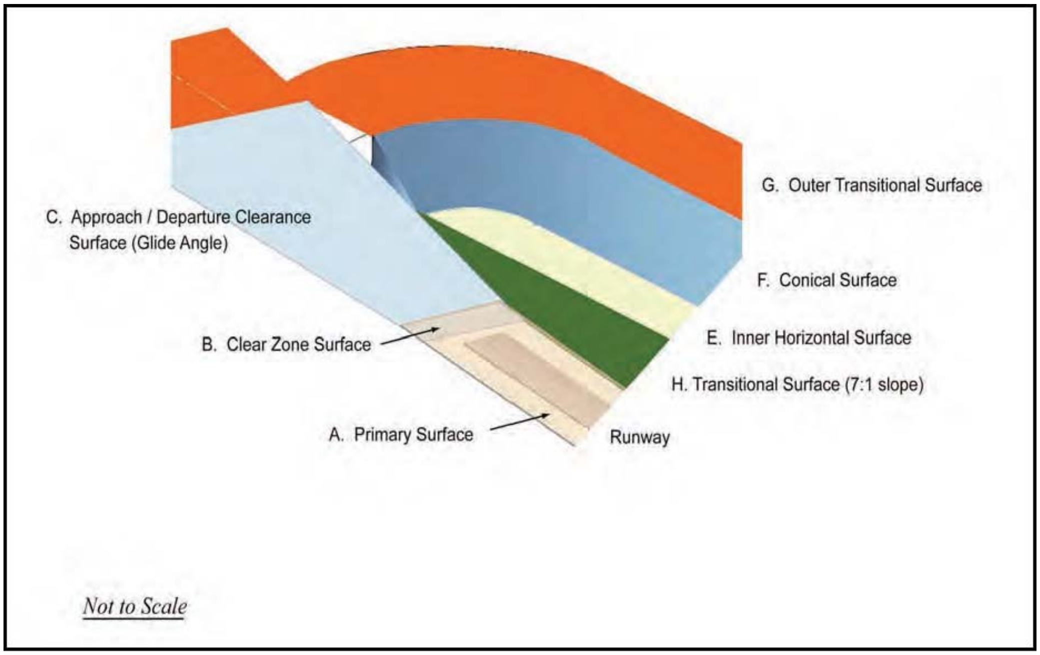


Figure D–2 Three-Dimensional View of 14 CFR 77 Imaginary Surfaces

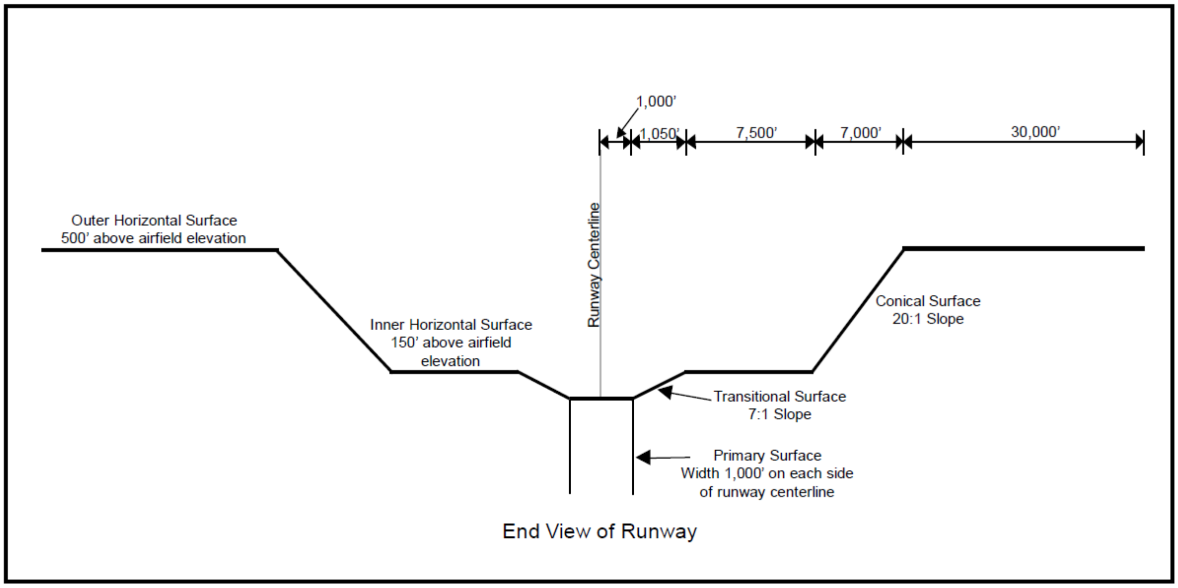


Figure D–3 Cross-Section View of 14 CFR 77 Imaginary Surfaces

D.3.1 Landing Zone Planes and Surfaces

The following list contains definitions of the runway airspace imaginary surfaces for U.S. Air Force LZs for C-130 aircraft. Airspace imaginary surfaces are defined in Chapter 7 of U.S. Department of Defense Unified Facilities Criteria 3-260-01, *Airfield and Heliport Planning and Design*.

- **Primary Surface** – For an LZ, the primary surface begins at the end of the runway, extends to the end of the CZ (runway length plus 500 feet on each runway end), and is 150 feet wide.
- **Clear Zone Surface** – For an LZ, the CZ begins at the end of the runway and is 500 feet long.
- **Approach-Departure Clearance Surface** – The LZ Approach-Departure Clearance Surface is an imaginary surface with an inclined plane that is arranged symmetrically along the extended centerline of the runway and begins 500 feet from the end of the runway. The LZ Approach-Departure Clearance Surfaces are 10,500 feet long and begin with a width of 500 feet, flaring uniformly at a 35:1 slope, to a width of 2,500 feet at 10,500 feet from the inner edge.

D.4 HEIGHT RESTRICTIONS

City/county agencies involved with approvals of permits for construction should require developers to submit calculations that show that projects meet the height restriction criteria of Unified Facilities Code 03-260-01, *Airfield and Heliport Planning and Design*, as described, in part, by the information contained in this section. For a more complete description of airspace and control surfaces for Class A and Class B runways, refer to Unified Facilities Code 03-260-01, *Airfield and Heliport Planning and Design*.

D.5 TOPOGRAPHY SURROUNDING DYESS AFB

Guidance in Title 14 of the *Code of Federal Regulations* (CFR) Part 77 states that the area surrounding a runway must be kept clear of objects that might damage an aircraft and therefore is bounded by imaginary airspace control surfaces that are defined in Section D.3. Per 14 CFR Part 77, an object is classified as an obstruction to air navigation if the object is more than 500 feet above ground level at the site of the object or exceeds the height of the imaginary airspace control surfaces. The purpose of these imaginary airspace control surfaces is to enhance the safety and efficiency of aircraft operations. The imaginary airspace control surfaces are established in relation to the established elevation of the airfield, which for Dyess AFB is 1,788 feet above mean sea level (MSL). For example, the height of the Outer Horizontal Surface is 2,288 feet MSL, which is the Dyess AFB established airfield elevation (1,788 feet MSL) plus the height of the surface itself (500 feet).

What drives the obstruction issue at Dyess AFB is the rising ground elevation to the southwest of the installation. In this area, structures do not have to be very tall to be an obstruction. The terrain itself already penetrates the Outer Horizontal Surface in multiple locations (as shown in Figure D–4) and any objects constructed in this area would be an obstruction to navigable airspace. For example, if a 150-foot-tall wind turbine were to be built to the southwest of Dyess AFB on a hilltop that has an elevation of 2,200 feet MSL, the top of the wind turbine would be at an elevation of 2,350 feet MSL. Since the Outer Horizontal Surface is 2,288 MSL, the combination of the terrain and the wind turbine would be an obstruction to Dyess AFB navigable airspace because the top of the turbine would extend 61 feet above the Outer Horizontal Surface.

D.6 DROP ZONE CRITERIA

Marrion Drop Zone. C-130 aircraft stationed at Dyess AFB train at the Marrion Drop Zone west of Dyess AFB (see Figure D–5). Training procedures include dropping heavy equipment and personnel over the Marrion Drop Zone from C-130 aircraft. Aircraft are usually flown in stacked formations. The required size of the Drop Zone, i.e., the drop target area, increases as the altitude of the aircraft increases. The Marrion Drop Zone is 3,000 feet (1,000 yards) wide by 3,300 feet (1,100 yards) long, allowing drops from up to 3,029 feet MSL. Any higher, and the minimum required Drop Zone is more than the Marrion Drop Zone can accommodate.

Aircraft must maintain an altitude that allows them to clear any known obstacles by 500 feet. Therefore, any structure within 3 nautical miles of the Drop Zone entry/exit centerline that raises the minimum altitude would negatively affect training with the C-130 aircraft since it would cause the aircraft to complete its drop from a higher altitude than can be accommodated within the confines of the Drop Zone.

Tennyson Drop Zone. In addition to the Marrion Drop Zone, C-130 aircraft utilize the Tennyson Drop Zone, as shown in Figure D–5. The Tennyson Drop Zone is southwest of Dyess AFB in Runnels and Coke County, 15 miles west of Ballinger, Texas. Most of the training with C-130 aircraft is conducted at the Tennyson Drop Zone. The Tennyson Drop Zone is 5,400 feet long by 4,200 feet wide. C-130 formations approaching the Tennyson and Marrion Drop Zones will usually be between 800 and 1,200 feet above ground level at 130–140 knots through the completion of their drops.

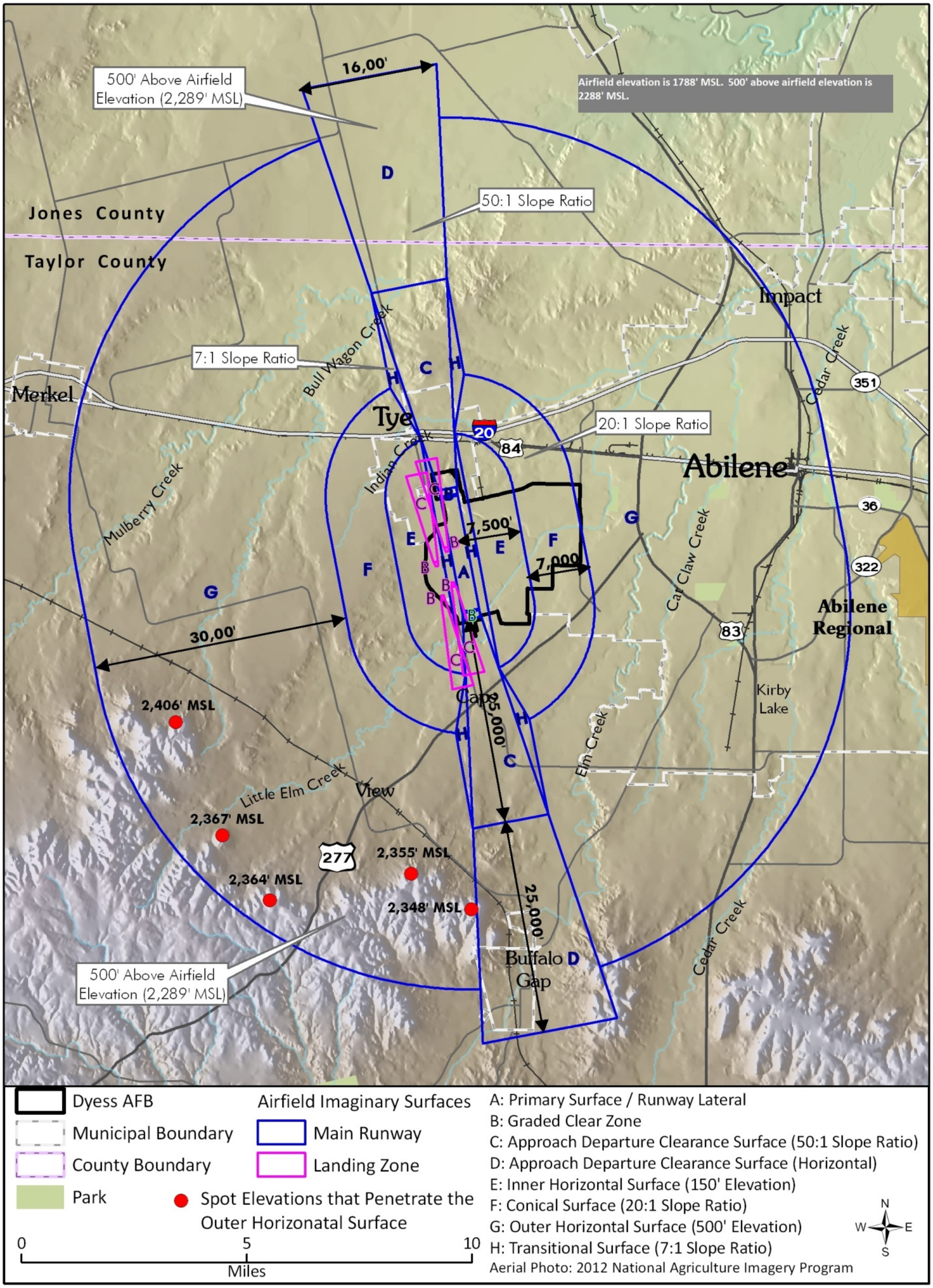


Figure D–4 FAA Imaginary Surfaces (Including Spot Elevations)

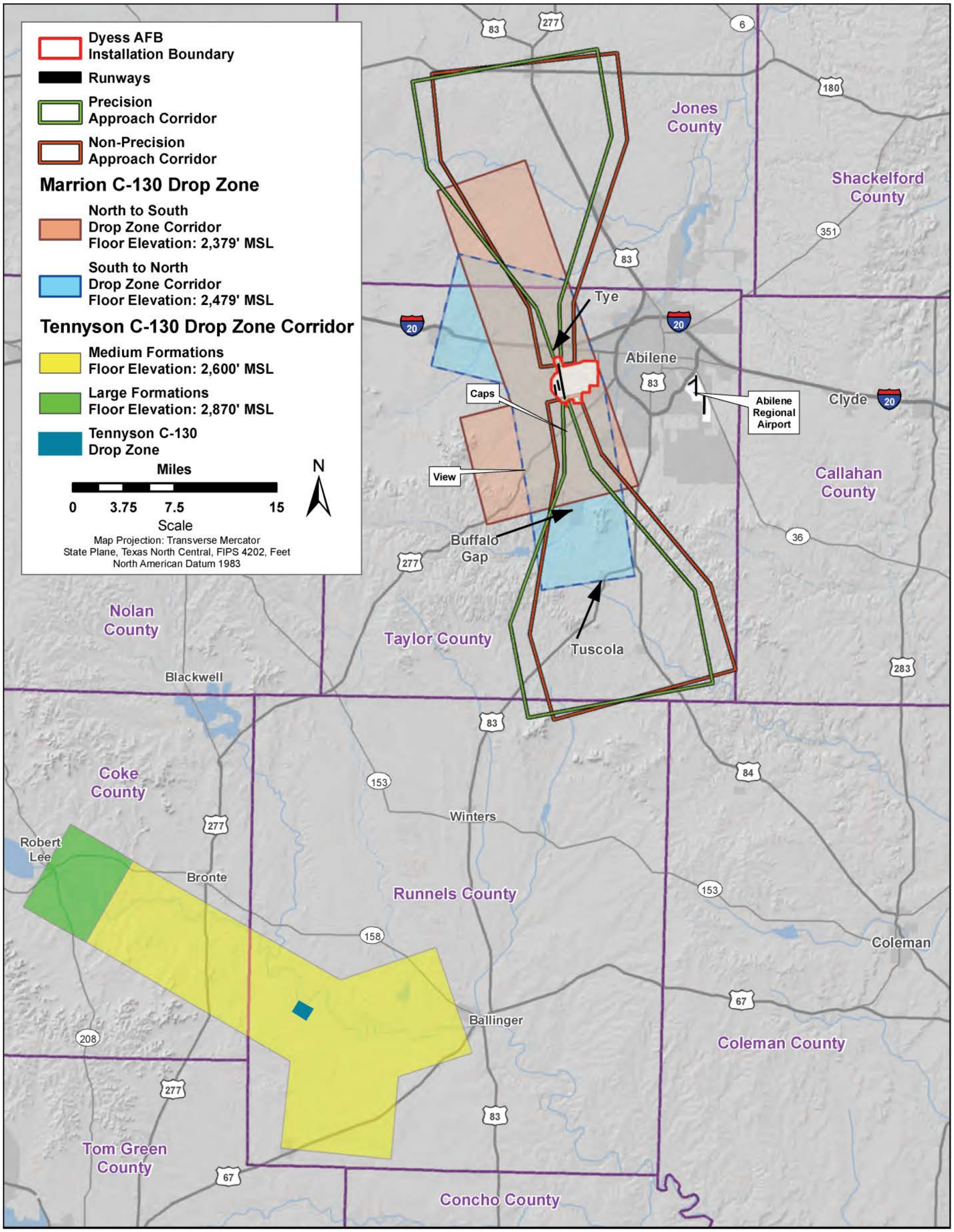


Figure D–5 Marrion and Tennyson Drop Zones at Dyess AFB

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APPENDIX E

NOISE-LEVEL REDUCTION GUIDELINES

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APPENDIX E. NOISE-LEVEL REDUCTION GUIDELINES

Wyle Labs completed a study for the Naval Facilities Engineering Command in April 2005, titled *Guidelines for Sound Insulation of Residences Exposed to Aircraft Operations* (U.S. Navy 2005). The study provides in-depth noise-level reduction guidelines.

Copies of this study are available online at http://www.fican.org/pdf/Wyle_Sound_Insulation.pdf.

E.1 BUILDING CODE MODIFICATIONS

Building codes can ensure that the structural requirements for a safe building are met. Local codes can address the noise levels to which the structures are subjected. The general objective is to achieve a maximum interior noise level of 45 decibels day–night average sound level (dB-DNL) or lower. Codes can include acoustical treatment standards for new or modified noise-sensitive structures and sound-attenuating construction techniques. Building code modifications can also establish sound insulation standards, such as wall insulation values, double-pane windows, and roof insulation.

Local jurisdictions are responsible for modifying community building codes or adopting a state building code that includes provisions for soundproofing structures impacted by aircraft noise. Provisions for building code modifications, to include sound insulation from exterior noise sources, require local legislation and enforcement by building inspectors. Additional sound insulation can slightly increase the cost of the construction but provide significant benefits.

Zoning and building standards can require the incorporation of noise-level reduction (NLR) measures for construction potentially affected by aircraft noise beyond established threshold levels and limit the types of land uses allowed in areas impacted by noise and accident potential, as previously described. Adoption and strict enforcement of these ordinances by local governments can effectively limit incompatible land uses.

The 2005 U.S. Navy Guidelines for Sound Insulation of Residences Exposed to Aircraft Operations (U.S. Navy 2005) provides a comprehensive overview of sound insulation techniques for homeowners and builders who are concerned about modifying an existing residence or constructing a new residence that incorporates sound insulation principles. A typical home built with standard design and materials might provide 20 to 30 dB-DNL of NLR from military aircraft noise exposure. In contrast, an acoustically well-insulated home can provide 30 to 35 dB-DNL of NLR. Providing more than 35 to 40 dB-DNL of NLR is not usually practical for a residence.

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