The Federal Aviation Administration's Airport Surveying-GIS Program

For more information, please visit the new Survey Website at:

http://airports-gis.faa.gov

The Federal Aviation Administration is putting a new process for conducting aeronautical surveys into place. There are two critical components to the FAA's new Airport Surveying-GIS Program:

- A New Web-Based Aeronautical Survey Process
- A New Airport Geographic Information System (GIS) Website

With the development of Satellite Navigation (SATNAV) technology, the need for a highly-accurate digital representation of an airport has become a critical element in the implementation of that technology, both in support of vertically-guided approaches, or in the movement of aircraft in poor visibility. For the first time in history, the movement of aircraft isn't tied to ground-based navigation. With this new freedom comes the need to know the surfaces and obstacles that could hinder aircraft movement, both in the air and on the ground, with more accuracy then ever before.

The FAA's new Airport Surveying Program is being put in place to meet the current and the future needs of airports as we move into the 21st century. With this new Survey Process, airports will have the ability to use private surveyors to perform standardized Aeronautical Surveys through the Federal Grant Program, State aviation funds, or even local sources, for the first time. This process will be a web-based application that will allow airport managers and independent surveyors access to detailed technical guidance on how to procure funding and contractors, as well as how to conduct standardized surveys. National Geodetic Survey (NGS), within the National Oceanic and Atmospheric Administration (NOAA), has developed a detailed set of instruction manuals that will guide private surveyors in conducting obstruction surveys in accordance with FAA Specification No. 405, Standards for Aeronautical Survey and Related Products.

There are manuals for:

- Establishment of Geodetic Control (PACS/SACS)
- Acquisition of Airport Imagery
- Airport Ground Surveys (NAVAIDs, Runways, Obstructions, Movement Areas)
- Exchange File Format
- Plannimetric Detail - Acquisition and Submission Formats (in development)
- GIS Airport Data (in development)

Airport managers, survey contractors, and FAA personnel will have access to these manuals, as well as other relevant survey documentation. Guidance material, template, sample documents, and manuals will all be available to download in PDF format within the FAA's new Airport Surveying-GIS Program website.

The new Web-Based Aeronautical Survey Process is a move forward because:

- Airports control funding
- Documentation may be accessed electronically
- Survey data will be electronically delivered to NGS/AVN (FAA organization is responsible for procedure development)
- Provide a centralized GIS for airports to submit survey and electronic airport layout data
- Independent contractors will primarily perform the surveys

Additional benefits of the new Web-Based Aeronautical Survey Process include:

- Maximize expenditures
- Eliminate survey duplication
- Standardize processes
- Increase the annual number of validated aeronautical surveys conducted
- Develop a digital map of the airport

The near term goal of the new Airport Surveying Program is to complete the necessary tools for an airport to plan, fund, and implement the infrastructure needed to support an approach for any given runway, independent of ground-based navigational equipment.

Included as part of the new Web-Based Aeronautical Survey Process will be the Airport Geographic Information System (GIS) website, also known as the eALP. The GIS site will provide a central warehouse for airport survey and layout data. The goal of this system is to provide a web-based spatial database to public airports through a flexible and easy-to-use interface for the exchange of spatial airport information. This system will become the conduit for public airports and consultants to submit all electronic airport layout and general airport survey data to the FAA, as well as the mechanism for the FAA to publish airport layout-related information for airports.

The purpose of the new Airport GIS Website is to:

- Provide the necessary tools for private industry to perform and maintain OC and ANA surveys
- Provide the means for airports and surveyors to capture and provide survey data in a digital form
- Provide non-GIS equipped airports with a GIS foundation
- Increase data availability
- Expedite production of FAA charts and improve response to airport changes
- Provide public airports and consultants with the ability to access electronic Obstruction Charts on-line

Key Features of the new Airport GIS Website include:

- Map rendering and viewing of geographic airport information
- Obstruction Chart display
- Conversion between major graphical design file formats and the GIS
- Multiple configuration/version support for analysis, planning, construction phasing, and other uses
- Analysis with 3D airport design and Obstruction Identification Surfaces

As part of the Airport GIS System effort, the FAA is consolidating all FAA airport data requirements into a new standard for airport layout data that will be used by FAA and industry. This specification is based upon the Safe Flight 21 specification, FAA #405, RTCA DO-272, RTCA DO-276, and NGS Volumes.

The New Airport Surveying-GIS Website will be located at:
http://airports-gis.faa.gov

Please Stay Tuned...

U.S. Department of Transportation

Federal Aviation Administration

FAA No. 405

STANDARDS FOR AERONAUTICAL SURVEYS AND RELATED PRODUCTS

Fourth Edition-September 1996

Aeronautical Information Services (ATA-100)

FAA NO. 405

STANDARDS FOR AERONAUTICAL SURVEYS AND RELATED PRODUCTS

FOURTH EDITION
SEPTEMBER 1996

FAA No. 405

United States Government
STANDARDS FOR AERONAUTICAL SURVEYS
AND RELATED PRODUCTS
Fourth Edition, September 1996

The standards contained in this manual have been developed by the Federal Aviation Administration (FAA) and the National geodetic survey (NGS) for use in the preparation of AERONAUTICAL SURVEYS, AIRPORT OBSTRUCTION CHARTS and RELATED PRODUCTS. These standards shall be complied with, without deviation, until such time as they are amended by formal FAA specification action.

New or revised pages to these standards will be provided when necessitated by new requirements.

Questions on interpretation that arise in the use of this manual shall be referred to the Division Manager, Aeronautical Information Services, ATA-100, Federal Aviation Administration, Washington, DC 20591.

APPROVED BY:

_____

Division manager, Aeronautical Information Services, ATA-100
Federal Aviation Administration
U.S. Department of Transportation

FAA No. 405

AMENDMENT OF STANDARDS

1. PROCEDURE

Recommendations for amendments to standards shall be directed to:

DOT/Federal Aviation Administration
Aeronautical Information Services, ATA-100
800 Independence Ave SW
Washington, DC 20591

2. AMENDMENT SYSTEM

a. Changes to the standards will be issued in the form of Change Notices.

b. Change Notices, which may contain more than one change, will be identified by the standards title/number, edition, and effective date, and will be consecutively numbered. Changes conveyed by the Notices shall remain in effect until revised by a subsequent Change Notice or a new edition of the standards.

c. The standards number, change number, and date will be indicated in the lower right corner of each revised or additional page.

d. Vertical lines in the right margin of the text mark the location of substantive standards changes. The accompanying cover page explains the intent of the change and provides information for proper interpretation.

e. "Editorial Change" at the left bottom of the page indicates that revisions have been made that do not change the intent of the standards; e.g., changes in wording, numbering of paragraphs or pages, or page makeup. This notation will not appear whenever editorial and substantive changes are on the same page.

FAA No. 405
STANDARDS FOR AERONAUTICAL SURVEYS AND RELATED PRODUCTS
FOURTH EDITION

EXPLANATION OF CHANGES
CHANGE 1
EFFECTIVE APRIL 15, 1998

PURPOSE: To implement approved changes to FAA No. 405.

DISTRIBUTION: Normal distribution for this document.

CHANGED PAGES:

New Page(s)	Replaces	Old Page(s)
2.14		2.14
TABLE 3.3		TABLE 3.3
3.9		3.9
FIGURE 3.5		FIGURE 3.5
FIGURE 3.6		FIGURE 3.6
A2.1		A2.1
FIGURE A2.1		FIGURE A2.1
A5.6		A5.2
A5.8		A5.8
G11		G11

SUMMARY OF CHANGES:

Page 2.14

Changes the decimal places reported for the latitude and longitude of runway ends and displaced thresholds from three decimal places in seconds to four decimal places in seconds. Four decimal places are required when computing geodetic azimuths to match published azimuths.

Changes the decimal places reported for the latitude and longitude of the Airport Reference Point from three decimal places in seconds to one decimal place in seconds. ARP is a theoretical point and reporting ARP to more than 0.1 second is not significant.

TABLE 3.3

Changes the elevation at 2,566 ft. to read: "51.3 FT. ABOVE THRESHOLD."

Changes the elevation at 50,000 ft. to read: "1,446.4 FT. ABOVE THRESHOLD."

Page 3.9

Deletes the requirement for the highest obstruction between the threshold at the runway stop end and the stop end of the primary surface. Obstructions in this area are covered by other survey requirements.

Deletes the requirement for the highest man-made object that is within the first 2,566 feet of an approach area and also higher than the threshold. This object frequently does not obstruct the approach surface. This change eliminates the expensive requirement to survey fence posts, guard rails, sheds, and other insignificant man-made objects that are often embedded in much higher obstructions. These objects are frequently difficult for surveyors to measure and the process of determining the highest among them can be very time consuming.

FIGURE 3.5

Makes FIGURE 3.5 consistent with text changes.

FIGURE 3.6

Makes FIGURE 3.6 consistent with text changes.

Page A2.1

Changes "RUNWAY CENTER POINT" in description of the Airport Reference Point (ARP) computation to "APPROXIMATE RUNWAY CENTER POINT" and defines approximate runway center point as the mean of the latitudes and mean of the longitudes of the ends. This change eliminates the need to use complex geodetic formulas to determine the precise runway center point position for the ARP computation. By using the mean method, ARP positions can be easily computed using only a four function, handheld calculator, allowing simple and consistent ARP computations.

For airports below 70 degrees latitude, the difference in the ARP position as computed by the "precise" or "mean" method is less than 0.02 seconds in latitude and no difference in longitude.

FIGURE A2.1

Makes FIGURE A2.1 consistent with text changes.

Page A5.6

Changes vertical accuracy requirements (orthometric and ellipsoidal) for Airport Obstruction Chart surveys from 20 feet to 50 feet for the areas indicated in the table on this page.

Page A5.8

Changes vertical accuracy requirements (orthometric and ellipsoidal) for Area Navigation Approach (ANA) obstruction surveys from 20 feet to 50 feet for the areas indicated in the table on this page.

Richard V. Powell
Division Manager, Aeronautical Information Services, ATA-100

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SECTION 1

INTRODUCTION

SECTION 1: INTRODUCTION

The aeronautical surveys and related products covered in this document provide information critical to the operation of the National Airspace System (NAS). Most of this information is source data, being acquired by field survey and/or photogrammetric methods.

Information furnished under these standards includes:

- Geodetic control data for permanent survey monuments established in the airport vicinity. These monuments and their accurate connections to the National Spatial Reference System (NSRS), assure accurate relativity between surveyed points on an airport and between these points and other surveyed points and facilities in the NAS, including the navigation satellites.

- Runway and stopway data, including runway end, stopway end, and displaced threshold positions and elevations, runway geodetic azimuths, touchdown zone elevations, and runway/stopway profiles

- Navigational aid (NAVAID) data, including NAVAID position and elevation, type, and distance from runway end and runway centerline

- Obstruction data, including obstruction description, position and elevation, and amount penetrating an Obstruction Identification Surface (OIS)

- Planimetric detail, including taxiways and aprons, and delineations of features of landmark value, such as, rivers, lakes, tidal shorelines, and major highways

- Aerial photograph coverage of the airport vicinity

This information is used to:

- Develop instrument approach and departure procedures

- Certify airports for certain types of operations, including those conducted under Federal Aviation Regulations Part 139

- Determine maximum takeoff weights for civil aircraft

- Update official U.S. Government aeronautical publications

- Provide geodetic control for engineering projects related to runway/taxiway construction, NAVAID siting, obstruction clearing, road building, and other airport improvement activities

- Assist in airport planning and land use studies in the airport vicinity

- Support miscellaneous activities, such as, aircraft accident investigations and special purpose one time projects

The precise meaning of terms is always important to a clear understanding of spoken or written information. This understanding is especially critical in technical areas where safety is involved. Certain terms and expressions used in this document have specific meanings that must not be misconstrued or applied incorrectly.

Critical terms are defined in the glossary located at the end of this publication. Many of these definitions have come from the "Aeronautical Information Manual" published by FAA and the "Geodetic Glossary" published by the National Geodetic Survey. Other definitions have been developed as needed.

In addition to the word usage as defined in the glossary, the following conventions have been adopted:

- The term "should" implies a first choice or preference but does not imply mandatory compliance. The term "shall" means that compliance is mandatory.

- The contraction "N/A" means not applicable.

- The term "position" means latitude and longitude unless otherwise specified.

- The term "mean sea level" (MSL) implies orthometric height. MSL is used throughout the NAS when reporting altitude values. In actuality, these altitudes are relative to a vertical datum that approximates mean sea level and are correctly referred to as "orthometric heights." While the mean sea level elevation phraseology is retained in this document, the more technically correct orthometric height is implied.

Because of the position and elevation uncertainties implied in horizontal and vertical accuracy standards (no position or elevation determined through measurement is error free), users of data provided under these standards must allow for these position and elevation uncertainties in the operational use of this information.

Future aviation will be heavily dependent on satellite navigation systems, such as, the Global Positioning System (GPS). GPS navigation requires that both the aircraft and destination coordinates be accurately known. This concept differs from conventional navigation which requires accurate tracking of a ground based signal, with coordinates of secondary importance. With GPS navigation, coordinates and geodetic datums become extremely important.

Ideally, coordinates should be referenced to a high accuracy global datum, such as, the International Earth Rotation Service (IERS) Terrestrial Reference Frame (ITRF). However, surveys, whether accomplished using classical or GPS methods, are conducted relative to control stations, including Continuously Operating Reference Stations (CORS). Therefore, it is impractical to deliver aeronautical data with global datum coordinate until these global coordinates become available to the surveyor.

Eventually, regional datums, such as, the North American Datum of 1983 (NAD 83) and the European Terrestrial Frame 1989 (ETRF89), will probably be replaced by a global system, such as, ITRF. However, as long as regional datums are used, they should meet the following three criteria:

1 - the datum, or more specifically, the positions and/or elevations of control stations that physically represent the datum, must be sufficiently accurate to support required surveys.

2 - the datum must be represented on the ground by a control station network that is readily available to the surveyor.

3 - the datum should be consistent (at about the two meter or better level) with a global datum, such as, ITRF, thereby ensuring smooth flight transitions between datums.

NAD 83 fully meets these criteria and has been selected as the FAA No. 405 standard for positions and ellipsoid heights in the United States. This datum has been developed by the National Geodetic Survey, United States Department of Commerce, and implemented to support virtually all surveying, charting, and navigation requirements. In addition, NAD 83 has been adopted by the Federal Geodetic Control Subcommittee as the official geodetic datum for the United States. (See Federal Register/Vol 54 No 113).

SECTION 2

AIRPORT OBSTRUCTION CHART SURVEYS

SECTION 2
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AIRPORT OBSTRUCTION CHART SURVEYS

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FIGURES

SECTION 2: AIRPORT OBSTRUCTION CHART SURVEYS

1. DESCRIPTION

The Airport Obstruction Chart (AOC) survey is an extensive field/photogrammetric operation which provides aeronautical and other information to support a wide range of National Airspace System (NAS) activities.

AOC surveys provide source information on:

- Runways/stopways
- Navigational aids (NAVAID)
- Federal Aviation Regulations Part 77 (FAR-77) obstructions
- Aircraft movement and apron areas
- Prominent airport buildings
- Selected roads and other traverse ways
- Cultural and natural features of landmark value
- Miscellaneous and special request items

AOC surveys also establish (if it does not exist) geodetic control in the airport vicinity consisting of permanent survey marks accurately connected to the National Spatial Reference System (NSRS). This control and the NSRS connection assures accurate relativity between surveyed points on the airport and between these points and other surveyed points in the NAS, including the navigation satellites. In addition, this control supports not only AOC surveys, but also future engineering activities, such as, runway/taxiway construction, NAVAID siting, obstruction clearing, road building, and other airport related projects.

AOC survey data is used to:

- Develop instrument approach and departure procedures
- Determine maximum takeoff weights for civil aircraft
- Certify airports for certain types of operations, including Federal Aviation Regulations Part 139
- Update official U.S. Government aeronautical publications
- Provide geodetic control for engineering projects related to runway/taxiway construction, NAVAID siting, obstruction clearing, road building, and other airport improvement activities
- Assist in airport planning and land use studies in the airport vicinity
- Support miscellaneous activities, such as, aircraft accident investigations and special purpose one time projects

Standards for AOC survey products are described in detail in Subsection 10 of this section.

Unless otherwise stated, all data provided in accordance with this section is current as of the time of the AOC field survey.

2. DATUM TIE AND LOCAL CONTROL

Datum tie and local control requirements for all surveys accomplished in accordance with FAA No. 405 standards are identified in Appendix 3.

3. ACCURACIES

Accuracy requirements for all data provided in accordance with FAA No. 405 standards are identified in Appendix 5.

4. RUNWAY AND STOPWAY POINTS

Runway/stopway data shall be provided for all runways and stopways with a specially prepared hard surface (SPHS) existing at the time of the field survey. Data shall be provided for non-SPHS runways/stopways existing at the time of the field survey if: (1) they are depicted in the United States Government flight information publication "U.S. Terminal Procedures" current at the time of the field survey, (2) the runway/stopway survey was specifically requested by appropriate Federal Aviation Administration authorities, or (3) the stopway was officially designated a stopway by appropriate airport authorities.

Unless otherwise stated, all runway/stopway points shall be on the runway/stopway centerline.

Runways shall be identified by the number painted on the runway at the time of the field survey. If a number is not painted on the runway, the runway number published in the "U.S. Terminal Procedures" current at the time of the field survey shall be used.

4.1. REQUIRED DATA FOR RUNWAYS AND STOPWAYS

Required data for SPHS and Non-SPHS runways and stopways are presented in Table 2.1. (Also see Figure 2.1)

TABLE 2.1
REQUIRED RUNWAY/STOPWAY DATA

RWY/STWY POINT	REQUIRED DATA SPHS RWY	NON-SPHS RWY
AIRPORT ELEV	D/E	D/E
RUNWAY ENDS	P/E	P/E*
INTERSECTION OF SPHS RWYS	D/E	N/N
DISPLACED THLDS	P/E	P/N
TOUCHDOWN ZONE	N/E	N/N
STOPWAY ENDS	D/E	D/E
SUPPLEMENTAL PROFILE POINTS	D/E	N/N
POINT ABEAM GS	P/E	N/N
POINT ABEAM MLSEL	P/E	N/N
POINT ABEAM OFFSET LOC	P/N	N/N
POINT ABEAM OFFSET LDA	P/N	N/N
POINT ABEAM OFFSET SDF	P/N	N/N
POINT ABEAM OFFSET MLSAZ	P/N	N/N

ELEVATION REQUIRED ONLY IF AN OBSTRUCTION SURVEY WAS PERFORMED
D = DISTANCE FROM RUNWAY'S: (1) NEAR END FOR AIRPORT ELEVATION, (2) APPROACH END FOR RUNWAY INTERSECTIONS AND SUPPLEMENTAL PROFILE POINTS, AND (3) STOP END FOR STOPWAYS
E = ELEVATION
N = POSITION, DISTANCE, OR ELEVATION IS NOT REQUIRED
P = LATITUDE AND LONGITUDE

A FACILITY IS CONSIDERED OFFSET IF LOCATED MORE THAN 10 FEET FROM THE RUNWAY CENTERLINE/CENTERLINE EXTENDED.

5. NAVIGATIONAL AIDS

5.1. ELECTRONIC NAVAIDS

A position, and sometimes an elevation, depending on the navigational aid (NAVAID), shall be determined for selected electronic NAVAIDS associated with the airport. The horizontal and vertical survey points for electronic NAVAIDS are listed in Appendix 4.

Survey data is required for NAVAIDS meeting all of the following three criteria:

- The NAVAID is listed in Appendix 4.

- The NAVAID is located within 10 nautical miles of the Airport Reference Point.

- The NAVAID is associated with an instrument approach procedure for the airport being surveyed and the procedure is published in the United States Government flight information publication "U.S. Terminal Procedures" current at the time of the field survey. This requirement also applies to Airport Surveillance Radars.

In addition to the NAVAIDS identified above, Airport Surveillance Radars and Air Route Surveillance Radars located within FAR-77 limits for the airport being surveyed, and not located on a military aerodrome, shall be routinely surveyed.

If the NAVAID is also an obstruction, the obstruction requirements of Subsection 6 of this section also apply.

5.2. VISUAL NAVAIDS

The position of a "plot point" or points shall be determined for certain visual NAVAIDS. The "plot point" may be the center of the NAVAID, or when the NAVAID is composed of more than one unit, the center of the unit array, or in the case of approach light systems, the first and last lights. A plot point is required if, and only if, the NAVAID is associated with the airport being surveyed.

Elevations are not required for visual NAVAIDS. However, if the NAVAID is also an obstruction, the obstruction requirements of Subsection 6 of this section also apply.

Required visual NAVAIDS and their plot points are identified below:

- Visual Glideslope Indicators (the most common types are listed below). Note that data is not required for "Alignment of Elements" systems.

  Precision Approach Path Indicator (PAPI) - Plot point is the center of the light array. Since PAPI systems usually have two or four light units installed in a row aligned perpendicular to the runway centerline, the array center (plot point) will be between units.

  Pulsating Visual Approach Slope Indicator (PVASI) - Plot point is the center of the projecting unit.

  Visual Approach Slope Indicator (VASI) - Plot points are the center of the near, middle (if present), and far VASI bars. Where two light units exist in a bar, the plot point shall be midway between the two units.

  Tri-Color Visual Approach Slope Indicator (TRCV) - Plot point is the center of the projecting unit.

  "T"-Visual Approach Slope Indicator (TVASI) - Plot point is center of light array.

- Approach Light Systems - Plot points are the first and last lights. Omnidirectional Approach Lighting System (ODALS) lights that function as Runway End Identifier Lights (REIL) shall be treated as REILs. Other ODALS lights shall be treated as approach lights.

- Runway End Identifier Lights (REIL) - Plot point is the center of each light.

- Airport Beacon - Plot point is the axis of light rotation.

6. OBSTRUCTIONS

6.1. DEFINITION

An obstruction, for purposes of this section, is any object that penetrates an obstruction identification surface (OIS) as defined in Federal Aviation Regulations Part 77 (FAR-77). A supplemental obstruction is any object that penetrates an OIS that has been defined as a supplemental OIS by appropriate FAA authorities.

6.2. OBSTRUCTION IDENTIFICATION SURFACES

OIS dimensions for AOC surveys are defined in FAR-77 for civil airports. (See Figure 2.2).

6.3. SPECIAL CASES

6.3.1. Catenaries

In most cases, the position and elevation of supporting towers will adequately represent catenaries. These towers shall be treated as any other potential obstruction. However, if one, or both towers are outside the limits of the OIS, the catenary itself may become a significant obstruction. In these cases, a position and elevation shall be provided on the imaginary straight line connecting the tops of the two adjacent catenary support towers at the highest point within the OIS. The elevation of this point shall be carried as an estimated maximum elevation (EME).

6.3.2. Vehicular Traverse Ways

In general, a vehicular traverse way shall be treated as any other potential obstruction, except that the appropriate vehicle height allowance must be included in the elevation. (See "Obstruction Exemptions" in this subsection for possible exemptions that may apply to vehicular traverse ways and Subsection 10. for additional requirements concerning vehicular traverse ways as planimetric detail).

Vehicle Height Allowances follow:

Noninterstate roads	15 feet
Interstate roads	17 feet
Railroads	23 feet

6.3.3. Mobile Obstructions

Representative obstructions that are mobile within a defined area (except vehicles on roads and railroads, and vessels, which are treated under separate headings) shall have their obstructing travel limits determined. An estimated maximum elevation (EME) shall be furnished for each of these obstructing mobile object areas.

If a nonobstructing mobile object is outward from the runway end, is the highest object in the primary area or first 2,000 feet of an approach, and is higher than the runway end, an EME point shall be provided at the point nearest to the runway centerline end. Travel limits need not be determined.

The word "MOBILE," which always implies an EME, shall be included in the object name, such as, "MOBILE CRANE".

(See Subsection 10. and Figure 2.7 and Figure 2.8 for proper depiction of mobile objects on AOC survey products).

6.3.4. Obstructions Under Construction

Representative objects that are under construction should be identified as being under construction, such as, "BUILDING UNDER CONSTRUCTION." The elevation at the time of the survey shall be carried. However, if a construction crane extends above the feature under construction, it is necessary and sufficient to carry the elevation and position of the crane.

6.3.5. Vessels

Because of uncertainties in determining maximum vessel heights, travel limits, and frequency of passage,

vessel heights and locations shall not be provided. However, if a possible obstructing condition exists, a note shall be entered on AOC survey products cautioning that vessels may obstruct certain OIS's at certain times and that further investigation by the data user regarding maximum vessel height, travel limits, and frequency of passage is advised. (See Subsection 10. for proper depiction on AOC survey products).

6.3.6. Manmade Objects Equal to or Greater than 200 Feet Above Ground Level (AGL)

The AGL elevation shall be determined for manmade objects equal to, or greater than, 200 feet AGL. The AGL shall be measured from the highest point of ground in contact with either the object or the structure on which the object rests. This AGL requirement applies only to representative objects that normally would be carried on AOC survey products and does not necessarily require measuring all manmade objects in the survey area that are equal to or greater than 200 feet AGL.

6.3.7. Supplemental Obstructions

An obstruction survey of a supplemental OIS shall be accomplished when specifically requested by appropriate FAA authorities. This survey shall be accomplished in addition to the survey specified in FAR-77 for existing conditions. Penetrations of the supplemental OIS are supplemental obstructions. The supplemental OIS shall conform to one of the OIS standards defined in FAR-77. Criteria for the selection of supplemental obstructions shall be the same as the criteria for the selection of other obstructions.

6.3.8. Obstruction Exemptions

The following obstructions are not required to be measured or carried on AOC products:

- Vegetation that is both obstructing by less than three feet and with a maximum cross sectional diameter no greater than one-half inch where transected by an obstruction surface.

- Annual vegetation, such as annual weeds, corn, millet, and sugar cane.

- Frangible objects under the control of airport authorities with locations fixed by function. Examples are runway and taxiway signs, and many approach light structures.

- Roads with restricted public access that are intended for airport/facility maintenance only. This exemption does not apply to airport service roads associated with other airport operations, such as, food, fuel, and freight transportation.

- Construction equipment and debris, including dirt piles and batch plants, that are: (1) temporary in nature, (2) under the control of airport authorities, and (3) located on airport property.

- Vessels. However, if a possible obstructing condition exists, a note shall be entered on AOC survey products cautioning that vessels may obstruct certain FAR-77 surfaces at certain times and that further investigation by the product user regarding maximum vessel height, travel limits, and frequency of passage is advised. This exemption does not apply to vessels that are permanently moored.

- Parked aircraft. The AOC shall show paved aircraft movement and apron areas and approximate locations of unpaved tiedown areas. However, the location and maximum elevation of individual parked aircraft cannot be determined and shall not be provided under AOC surveys. This exemption does not apply to aircraft permanently parked for display purposes.

6.4. SELECTION

Obstruction selection shall include a representation of objects that penetrated the FAR-77 OIS's at the time of the field survey. These surfaces shall be identified for the survey by appropriate FAA authorities. In addition, certain nonobstructing objects may be required in the first 2,000 feet of an approach area.

The special cases that apply to obstructions (see Subsection 6.3) also apply to these required nonobstructing objects.

Required objects/obstructions include:

- Primary Surface (See Figure 2.3)

  The highest obstruction outward from the runway end.

  The highest obstruction and the highest non man-made obstruction in each 3,000 foot (approximately) section of the primary area on each side of the runway.

- Approach Surface (See Figure 2.4 and Figure 2.5)

  The highest object that is both within the first 2,000 feet of an approach area and higher than the runway approach end. This object may or may not penetrate the approach surface and may be a nonobstructing EME point.

  The most penetrating obstruction in the first 2,000 feet of an approach area.

  The highest approach obstruction in: (1) first 10,000 feet, (2) first 20,000 feet, (3) first 30,000 feet, (4) first 40,000 feet, and (5) the approach area.

- Transition Surfaces (See Figure 2.6)

  The highest obstruction in each 3,000 feet (approximately) of each primary transition to the horizontal surface.

  The highest obstruction in each approach transition to the horizontal surface.

  The highest obstruction in each approach transition in the first 20,000 feet beyond the horizontal surface.

  The highest obstruction in each approach transition beyond the horizontal surface.

- Horizontal and Conical Surfaces

  The highest obstruction in either the horizontal or conical area in each quadrant of the FAR-77 survey area as defined by the meridian and parallel intersecting at the Airport Reference Point.

- Obstructing Areas (See Figure 2.7)

  An obstruction representation within the limits of each obstructing area to be compiled on the AOC. This representation shall include the following:

  The highest obstruction within each obstructing area.

  The highest obstruction within that portion of an obstructing area that penetrates an approach surface.

  The highest obstruction within that portion of an obstructing area that penetrates a primary surface.

Note that required objects may be EME points for mobile object areas.

In some cases, strict adherence to the object selection criteria listed above may result in congestion or inadequate obstruction representation. To minimize these situations, the following guidelines shall be followed in object selection:

- If objects that are required in the primary area or first 10,000 feet of an approach area are located within 100 feet of each other, the lower object may be omitted.

- If objects that are required outside the primary or first 10,000 of an approach area are located within 500 feet of each other, the lower object may be omitted. (Note: Required primary or

approach objects shall not be omitted because of the close proximity of higher objects outside of the primary or approach areas).

- When a required object is omitted because of congestion, a replacement object/objects shall be selected if possible that meets the spacing criteria.

- Occasionally, additional obstruction information may be useful in representing certain obstructing conditions. While rigorous selection criteria is not practical, information useful to obstruction clearing activities should be considered in the selection.

7. METEOROLOGICAL APPARATUS

Meteorological apparatus is not required unless it is to be carried for its elevation value.

8. PLANIMETRIC DETAIL

Planimetric detail to be provided by AOC surveys includes the following:

- All usable runways located on the AOC airport.

- Runways with specially prepared hard surfaces that are not located on the AOC airport but fall within the AP limits on the published AOC.

- Seaplane landing areas when associated with the AOC airport.

- Paved helipads that are isolated from other apron areas. These helipads may or may not be painted as helipads. Helipads on other apron areas need not be identified.

- Closed runways if they are sufficiently prominent to be of value to a pilot in airport identification.

- Aprons and taxiways with specially prepared hard surfaces.

- Approximate limits of non-SPHS tiedown areas if permanent tiedown fixtures are present and any portion of the area is located within 200 feet of a primary or approach obstruction identification surface. If any portion of the area meets these criteria, the entire tiedown area will be delineated.
- Traverse ways, dikes, transmission lines, fence lines, or other linear features having obstruction or landmark value.

- A selection of roads, especially in the airport vicinity, to assist the AOC user in geographic orientation.

- The terminal building complex, plus hangars, maintenance facilities, and other buildings directly associated with aircraft operations and directly connected to the apron.

- Approximate limits of obstructing areas.

- Coastlines, lakes, rivers, major highways and buildings, or other features of landmark value that aid in geographic orientation.

Elevation information is not required for planimetric detail charted only for its planimetric value. Features selected for their elevation as well as their planimetric value, such as, transmission lines, shall carry a representative spot elevation.

See Subsection 10. for proper depiction of planimetric detail on AOC survey products.

9. MISCELLANEOUS

AIRPORT REFERENCE POINT

The Airport Reference Point (ARP) shall be computed using the centerline end positions of all usable runways. However, since runways without specially prepared hard surfaces are often not required to be surveyed, the ARP position for these airports will be approximate. The ARP will be tagged with the year of the most recent runway end survey used in the ARP computation, such as, "ARP (1995)."

Procedures for computing ARP are presented in Appendix 2.

10. DATA DELIVERY

AOC survey data shall be furnished on the Airport Obstruction Chart or in ASCII files in the Universal Data Delivery Format (UDDF)

The content, portrayal, and format for each of these products is presented in this subsection.

10.1. AIRPORT OBSTRUCTION CHART (AOC)

10.1.1. DESCRIPTION

The AOC is a 1:12,000 scale graphic depicting Federal Aviation Regulations Part 77 (FAR-77) Obstruction Identification Surfaces (OIS), a representation of objects that penetrate these surfaces, aircraft movement and apron areas, navigational aids, prominent airport buildings, and a selection of roads and other planimetric detail in the airport vicinity. Also included, are tabulations of runway and other operational data. AOC data is current as of the date of the field survey.

The AOC consists of four sections:

- Airport Plan (AP)
- Runway Plans and Profiles (RPP)
- Tabulated Operational Data (TOD)
- Notes and Legends (NL)

Contents, portrayal, and general format shall conform to the style sheet (OC 000) presented in Appendix 7.

10.1.2. MATERIALS AND FORMAT

The AOC shall be published on E50 chart paper, or equivalent, as defined by the Joint Committee on Printing. Border dimensions in inches for the published chart shall be either 30x42 or 30x48. The long dimension in each case may be either in the north/south or east/west direction, depending on individual charting requirements. In addition, approximately 3/4 of an inch should exist between the border and the paper trim line. In those cases where the AP and the RPP will not fit on the front of the chart, the RPP shall be printed on the chart back. When this front/back format is used, a 1:12,000 scale runway layout diagram showing runway numbers and north arrow shall be included on the chart back.

10.1.3. AIRPORT PLAN (AP)

Unless specifically modified because of special charting requirements, the AP shall be published at a horizontal scale of 1:12,000. Contents, portrayal, and general format shall conform to the style sheet (OC 000) presented in Appendix 7. The following items further define or clarify certain AP requirements.

10.1.3.1. RUNWAYS/STOPWAYS/BLAST PADS

This subsection lists the requirements for the graphic depiction of runway data on the AP.

Depiction on the AP depends on surface type and whether an obstruction survey was accomplished. Depiction shall comply with the following conventions:

A. Specially Prepared Hard Surface (SPHS) Runways with an Obstruction Survey (see Figure 2.10 and Figure 2.11)

- Outline solid.
- Length and width labeled in whole feet.
- Surface type labeled "PAVED" if paved and labeled "UNPAVED" for all other surface types.
- Displaced Threshold (DTHLD)

  Solid line perpendicular to runway centerline at the DTHLD but not touching runway outline.

Elevation depicted by 1 mm filled circle placed tangent to touchdown side of DTHLD line and labeled to one decimal place in feet.

Labeled "DISPLACED THRESHOLD" with length labeled to whole feet.

Use leader pointing to DTHLD with label, such as, "400 FT. DISPLACED THRESHOLD."

- Physical End Elevation

Depicted by a 1 mm filled circle placed tangent to touchdown side of runway end line

Elevation labeled to one decimal place in feet.

- Airport Elevation

Depicted by a 1 mm filled circle placed at airport elevation location.

Labeled to one decimal place in feet

Elevation enclosed in a solid line box.

- Touchdown Zone Elevation (TDZE)

The TDZE shall not be depicted on the AP. (The TDZE shall be indicated in the Tabulated Operational Data section of the AP but only for SPHS runways with a landing length equal to, or greater than, 3,000 feet).

- Supplemental Profile Points

Depicted by a 1 mm filled circle on runway centerline.

Selected so that a straight line between any two adjacent published runway/stopway points shall not be greater than one foot from the runway/stopway surface.

Labeled to one decimal place in feet.

- Magnetic Bearing

Shown in whole degrees with direction arrow near each runway end.

- Runway Numbers

Shown in their true locations as painted on runway at the time of the field survey. If no number is painted on runway, runway number published in the United States Government flight information publication "U.S. Terminal Procedures" current at the time of the field survey shall be shown on runway with the base of the number approximately 100 feet from the threshold.

B. SPHS Runways Without an Obstruction Survey

Depiction shall be the same as for SPHS runways with an obstruction survey.

C. Non-Specially Prepared Hard Surface (non-SPHS) Runways with an Obstruction Survey

Depiction shall be the same as for SPHS runways with an obstruction survey except outline shall be dashed and runway always labeled "UNPAVED".

D. Non-SPHS Runways Without an Obstruction Survey

Depiction shall be the same as for SPHS runways with an obstruction survey except outline shall be dashed, runway always labeled "UNPAVED," and airport elevation shall be only elevation point shown.

E. Blast Pads

Outline dashed.

Labeled "BLAST PAD."

Leader used as required in congested areas.

F. Stopways

Outline dashed

Labeled "PAVED STOPWAY" if paved and "UNPAVED STOPWAY" for all other surface types.

Length labeled to whole feet.

End elevation depicted with a 1 mm filled circle placed tangent to runway side of stopway end line and labeled to one decimal place in feet.

Leader used as required in congested areas.

Supplemental profile points selected so that a straight line between any two adjacent runway/ stopway points shall not be greater than one foot from the runway/stopway surface and labeled to one decimal place in feet.

The FAR-77 primary surface terminates at the runway end for non-SPHS runways and 200 feet beyond the physical runway end for SPHS runways.

Short Takeoff and Landing (STOL) runways shall be treated as other runways except that they shall be labeled "STOL" on the AP.

10.1.3.2. OBSTRUCTIONS

This subsection lists the requirements for the graphic depiction of obstructions on the AP.

Obstructions to be depicted on the AP and special considerations regarding obstructions are identified in Subsection 6.

Obstructions to a FAR-77 specified OIS shall be depicted with a 1 mm filled circle. Obstructions to a supplemental OIS only shall be depicted with an 2 mm open circle and superimposed cross. Nonobstructions and objects with no elevation information shall be depicted with a 1 mm open circle.

Estimated Maximum Elevations

Objects with estimated maximum elevations (EME), such as, catenaries, mobile objects, and some cranes, shall be shown with its EME, as in the following example:

"CATENARY
EME 344"

See Subsection 10.1.3.5. for delineation of linear features as planimetric detail.

Obstructing Areas (See Figure 2.7)

In areas of scattered obstructions, a representation of individual obstructions shall be shown. However, in areas considered to be continuously obstructing, such as, wooded areas, congested building areas, or ground, the entire obstructing area shall be indicated by an obstructing area symbol and a representation of individual obstructions within the area shall be shown.

Obstructing Mobile Objects (See Figures 2.8 and 2.9)

The obstructing travel limits of mobile obstructions shall be delineated by a dashed line and labeled with the EME of the area, as in the following example:

"OBSTRUCTING MOBILE CRANE AREA
EME 219"

If different EME's apply to different parts of the area, the area shall be subdivided with the appropriate EME note applied to each subarea.

If a nonobstructing mobile object is outward from the runway end, is higher than the runway end, and is the highest object in the primary surface or first 2,000 feet of an approach surface, an EME point, without an area limit, shall be provided on the AP at the point nearest to the runway centerline end. This EME point for nonobstructing mobile objects shall be a 1 mm open circle.

Obstructing travel limits of vessels shall not be delineated. However, the following note shall be

conspicuously placed on the AP cautioning the AOC user of possible obstructing vessels:

"POSSIBLE OBSTRUCTING VESSEL AREA CONTACT LOCAL AUTHORITIES FOR VESSEL INFORMATION"

(See Figure 2.8 and Figure 2.9)

Leadered Obstructions

Obstructions located beyond the AP limits on the published AOC shall be leadered. Obstructions penetrating a FAR-77 approach surface, including a supplemental surface, and obstructions penetrating the horizontal or conical surface only but located within the limits of the approach area, shall be leadered from the approach physical end of that runway. All other obstructions shall be leadered from the Airport Reference Point (ARP). Leadered distances shall be shown to the nearest whole foot.

10.1.3.3. NAVIGATIONAL AIDS

This subsection lists the requirements for the graphic depiction of electronic and visual navigational aids (NAVAIDS) on the AP. If the NAVAID is also an obstruction, Subsection 6. requirements also apply.

Both electronic and visual NAVAIDS identified in Subsection 5. and located within the limits of the AP on the published AOC shall be depicted on the AP and labeled with the NAVAID type. NAVAIDS located beyond the limits of the AP on the published AOC shall not be shown.

The horizontal survey point for electronic NAVAIDS shall be plotted. The plot point for visual NAVAIDS shall be plotted. In addition, approach light systems shall be symbolized between the plot points. (See Subsection 5 for visual NAVAID plot points).

An elevation shall not be shown unless the NAVAID is also to be carried for its obstruction value. In this case, only the top elevation shall be shown.

If no elevation is indicated, or the NAVAID does not obstruct, it shall be depicted with a 1 mm open circle. If an elevation is shown and the NAVAID obstructs, it shall be depicted with a 1 mm filled circle.

10.1.3.4. METEOROLOGICAL APPARATUS

Meteorological apparatus is not required unless it is to be depicted for its elevation value. In this case, it shall be treated as other objects.

10.1.3.5. PLANIMETRIC DETAIL

This subsection lists requirements for the graphic depiction of planimetric detail on the AP. See Appendix 7 for samples of these depictions.

Planimetric detail to be depicted in the AP section of the AOC shall include the following:

- All usable runways located on the AOC airport. Runways with specially prepared hard surfaces shall be delineated with a solid line. Runways without specially prepared hard surfaces shall be delineated with a dashed line. Paved runways shall be labeled "PAVED." All other runways shall be labeled "UNPAVED."

- Runways with specially prepared hard surfaces that are not located on the AOC airport but fall within the AP limits on the published AOC. These runways shall be delineated with a solid line and will include the airport name if available.

- Seaplane landing areas when associated with the AOC airport. These areas shall be labeled "SEAPLANE LANDING AREA" with no delineation.

- Paved helipads that are isolated from other apron areas. These areas shall be delineated with a solid line and labeled "HELIPAD." Helipads on other apron areas need not be identified.

- Closed runways if they are sufficiently prominent to be of value to a pilot in airport identification. Closed runways with specially prepared hard surfaces shall be delineated with a solid line. Closed runways without specially prepared hard surfaces shall be delineated with a dashed line. In both cases the runway shall be labeled "CLOSED RUNWAY."

- Aprons and taxiways with specially prepared hard surfaces. These items shall be delineated with a solid line.

- Approximate limits of non-SPHS tiedown areas if permanent tiedown fixtures are present and any portion of the area is located within 200 feet of a primary or approach obstruction identification surface. If any portion of the area meets these criteria, the entire area shall be delineated with a dashed line and labeled "UNPAVED TIEDOWN AREA."

- Traverse ways, dikes, transmission lines, fence lines, or other linear features having obstruction or landmark value. Feature delineation should be sufficient to allow positive feature identification by the chart user.

- A selection of roads, especially in the airport vicinity, to assist the AOC user in geographic orientation.

- The terminal building complex, plus hangars, maintenance facilities, and other prominent buildings directly associated with aircraft operations and directly connected to the apron. These items shall be hatched.

- Approximate limits of obstructing areas. These areas shall be depicted with an obstructing area symbol.

- Coastlines, lakes, rivers, major highways and buildings, or other features of landmark value that aid in geographic orientation.

Elevation information is not required for planimetric detail charted only for its planimetric value. Features selected for their elevation value as well as their planimetric value, such as, transmission lines, shall carry a representative spot elevation.

10.1.3.6. MISCELLANEOUS

This subsection lists the requirements for the graphic depiction of miscellaneous information on the AP.

Miscellaneous information to be depicted in the AP section of the AOC shall include the following:

- The latitude, longitude projection. The projection interval for all geographic areas, except Alaska, shall be one minute. In Alaska, the longitude projection interval shall be two minutes.

- The Airport Reference Point

- A compass rose oriented to geodetic north showing both geodetic north and magnetic north arrows. The magnetic variation at the time of the field survey shall be labeled along the magnetic arrow to the nearest tenth (0.1) of a degree. The official source for magnetic variation for the AOC and related products is the U. S. Geological Survey, Branch of Global Seismology and Geomagnetism, Denver CO.

- Specified FAR-77 OIS limits dashed.

- Supplemental OIS corners ticked and labeled "S."

- Runway centerline extended locator depicted.

- Elevation of floor of control tower cab shown in whole feet.

10.1.4. RUNWAY PLANS AND PROFILES (RPP)

The RPP content, portrayal, and general format shall conform to the style sheet (OC 000) presented in Appendix 7. The following items further define or clarify certain RPP requirements.

- Orientation

  The RPP shall be oriented so that for each runway the runway end with the highest longitude shall be to the left on the published AOC.

- Scale

  Horizontal scale shall be the same as the AP. Vertical scale shall be 1 inch = 100 feet.

- Area of Coverage

The extent of the RPP shall be limited to the primary and approach surface areas, including supplemental approach surface, as depicted in the AP. The longitudinal extent of the RPP will depend on obstruction locations in the approaches and the available space for the RPP on the published AOC.

The following guidelines should be followed, when practical, to determine RPP longitudinal limits:

- Extend the RPP at least 2,000 feet beyond the near runway end.

- Extend the RPP to a 1,000 foot multiple + 500 feet, such as, 5,500 feet, 8,500 feet etc. from the opposite runway end.

- Extend the RPP at least 500 feet beyond the last obstruction that penetrates the approach. If this extension is not practical, the RPP should be terminated at a convenient point that meets the criteria above. All approach obstructions located beyond this point shall be leadered with distances shown to the nearest whole foot.

- Content and Portrayal in Plan

The Plan portion of the RPP shall include:

The runway outline

Objects carried on the AP with a spot elevation.

EME points for obstructing mobile object areas. (The area but not the EME point is shown on the AP). EME point(s) shall be selected at: (1) the point nearest to the runway centerline end for primary surface penetrations, (2) the most penetrating point for approach surface penetration, and (3) as appropriate to represent the area. (See Figure 2.8 and Figure 2.9)

Taxiways and other planimetric detail carried in the AP shall not be shown in the RPP.

Objects that penetrate the approach or supplemental approach surface of the profiled runway and are located beyond the published limits of the RPP shall be leadered from the runway end with distances shown to the nearest whole foot. Objects within the limits of the approach or supplemental approach areas but penetrating the horizontal or conical surface only, shall not be leadered.

A runway centerline extended locator shall be placed in each approach in the Plan portion of the RPP.

- Content and Portrayal in the Profile

The profile shall include all objects carried in the Plan with spot elevations, including leadered obstructions.

If profiling all objects results in congestion in the Profile, lower objects may be omitted.

The line portrayal of objects in the Profile shall be 0.5 inch in length or extend to 0.1 inch below the elevation of the runway end, whichever is shorter.

The runway, and stopways when present, shall be depicted in the Profile portion of the RPP with the elevation of each profile point labeled.

Each Profile shall portray the specified approach surface and supplemental approach surface, if present. In addition, the Profile for specified PIR approaches shall depict a 34:1 surface in addition to the specified PIR surface.

- Object Numbering Scheme

  All profiled objects shall be numbered consecutively from left to right in the Profile with matching numbers for the corresponding objects in the Plan.

A north arrow shall be placed between each Plan and Profile.

When there is insufficient room to print the RPP on the AOC front, the RPP shall be printed on the AOC back. In these cases, a runway layout diagram, at the scale of the AP, showing runway numbers and a north arrow shall be included on the chart back.

10.1.5. TABULATED OPERATIONAL DATA (TOD)

TOD content, portrayal, and general format conform to the chart sample (OC 000) presented in Appendix 7. The following items further define or clarify certain TOD requirements.

TOD shall include:

- Airport Location Point (ALP)

  Latitude and longitude listed in degrees and whole minutes.

- Airport Reference Point (ARP)

  Latitude and longitude listed in degrees, minutes, and one decimal place in seconds.

- A Runway Data Table (RDT) depicting the following information for each usable runway:

  Runway number

  Latitude and longitude of the approach end listed in degrees, minutes, and four decimal places in seconds.

  Touchdown Zone Elevation (TDZE) listed to one decimal place in feet. This requirement applies only to runways with specially prepared hard surfaces equal to, or greater than, 3,000 feet in length.

  Geodetic azimuth from approach end to stop end, listed to whole seconds. The geodetic azimuth shall be reckoned from north.

  Runways with a displaced threshold shall be listed twice, once with the runway physical end coordinates listed and a second time with the displaced threshold coordinates listed , all carried to four decimal places in seconds. The runway azimuth shall be carried only with the physical end listing. The TDZE shall be carried only with the displaced threshold listing.

10.1.6. NOTES AND LEGENDS (NL)

NL content, portrayal, and general format shall conform to the chart sample (OC 000) presented in Appendix 7. The following items further define or clarify certain notes and legend requirements.

The following information shall be included in the notes and legend of the AOC:

- Horizontal datum shown in title box

- Vertical datum shown in title box

- Map projection shown in title box

- Airport elevation shown to one decimal place in feet in the upper left corner of the chart, inside of the margin

- Legend of chart symbols

- Graphic horizontal scales shown in feet, meters, nautical miles, and statute miles at the bottom center of chart, outside of the margin.

- Graphic vertical scale shown at lower right corner of chart inside of the margin.

- AOC edition number shown at lower left corner of chart, outside of the margin.

- Date of survey shown at lower left corner of chart, outside of the margin.

- Date of publication shown at lower left corner of chart, outside of the margin.

- Data source paragraph shown at lower left corner of chart, outside of the margin.

- Amendment data box shown at lower left corner of chart, inside of the margin.

- Airport name and associated city and state shown in upper center and lower right of chart, both outside of the margin.

- AOC number shown in upper left and lower right of chart, outside of the margin.

- Department of Commerce logo shown in upper center of chart, inside of the margin.

- Publication credit shown at lower center of chart, outside of the margin.

- "National Ocean Service" shown at upper right of chart, outside of the margin.

10.2. UNIVERSAL DATA DELIVERY FORMAT

10.2.1. DESCRIPTION

The Universal Data Delivery Format (UDDF) is a digital delivery system which provides aeronautical and other data, including airport, runway, navigational aid, and obstruction information in a standard ASCII format. This information can be easily read into user data files and data bases.

10.2.2. CONTENT AND FORMAT

General UDDF content, portrayal, and format information are presented in Appendix 1.

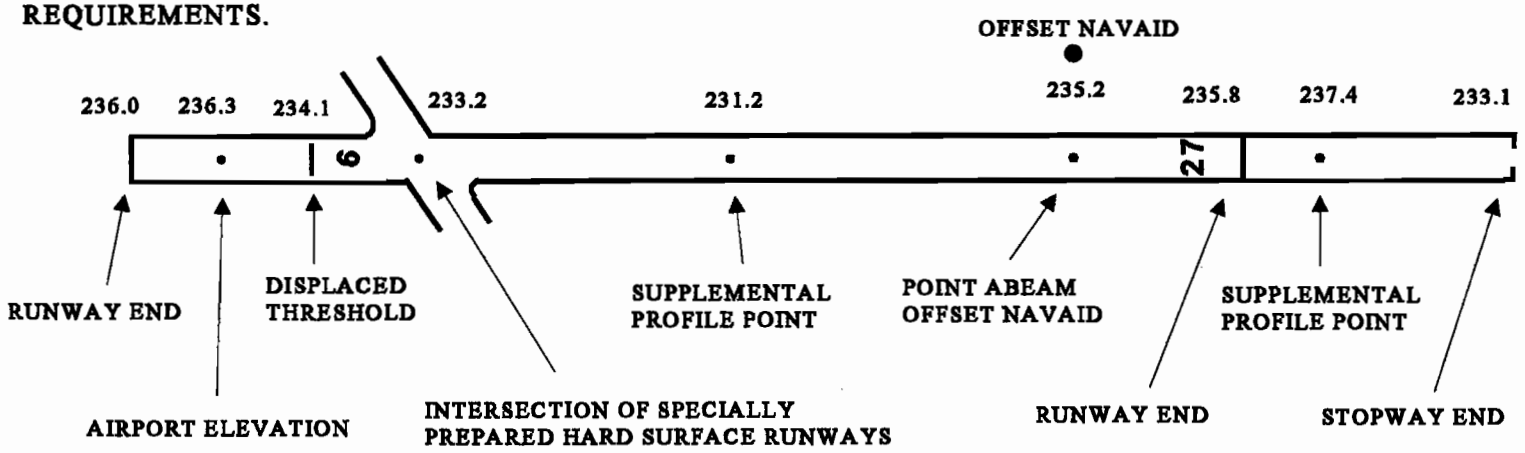
POSITIONS AND/OR ELEVATIONS (SEE TABLE 2.1) SHALL BE PROVIDED FOR: (1) RUNWAY ENDS, (2) DISPLACED THRESHOLDS, (3) TOUCHDOWN ZONES (ELEV ONLY), (4) RUNWAY INTERSECTIIONS, (5) AIRPORT ELEVATION, (6) POINT ABEAM CERTAIN OFFSET NAVAIDS, AND (7) STOPWAY ENDS.

TOUCHDOWN ZONE ELEVATIONS ARE REQUIRED ONLY FOR SPECIALLY PREPARED HARD SURFACE RUNWAYS WITH A USABLE LANDING LENGTH OF AT LEAST 3,000 FEET.

SEE TEXT AND TABLE 2.1 FOR NON-SPECIALLY PREPARED HARD SURFACE RUNWAY/STOPWAY REQUIREMENTS.

POSITIONS AND ELEVATIONS SHALL ALSO BE PROVIDED FOR SUPPLEMENTAL PROFILE POINTS, SELECTED SO THAT A STRAIGHT LINE BETWEEN ANY TWO ADJACENT PUBLISHED RUNWAY/STOPWAY POINTS WILL BE NO GREATER THAN ONE FOOT FROM THE RUNWAY/STOPWAY SURFACE.

RUNWAYS SHALL BE IDENTIFIED BY THE NUMBER PAINTED ON THE RUNWAY AT THE TIME OF THE FIELD SURVEY. IF A NUMBER IS NOT PAINTED ON THE RUNWAY, THE RUNWAY NUMBER PUBLISHED IN THE "U.S. TERMINAL PROCEDURES" CURRENT AT THE TIME OF THE FIELD SURVEY SHALL BE USED.



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 2.1

RUNWAY NUMBERS AND REQUIRED POINTS FOR SPECIALLY PREPARED HARD SURFACE RUNWAYS/STOPWAYS

This figure is currently not available
in .pdf format

FIGURE 2.2

OBSTRUCTION IDENTIFICATION SURFACES
FEDERAL AVIATION REGULATIONS PART 77

9/1/96

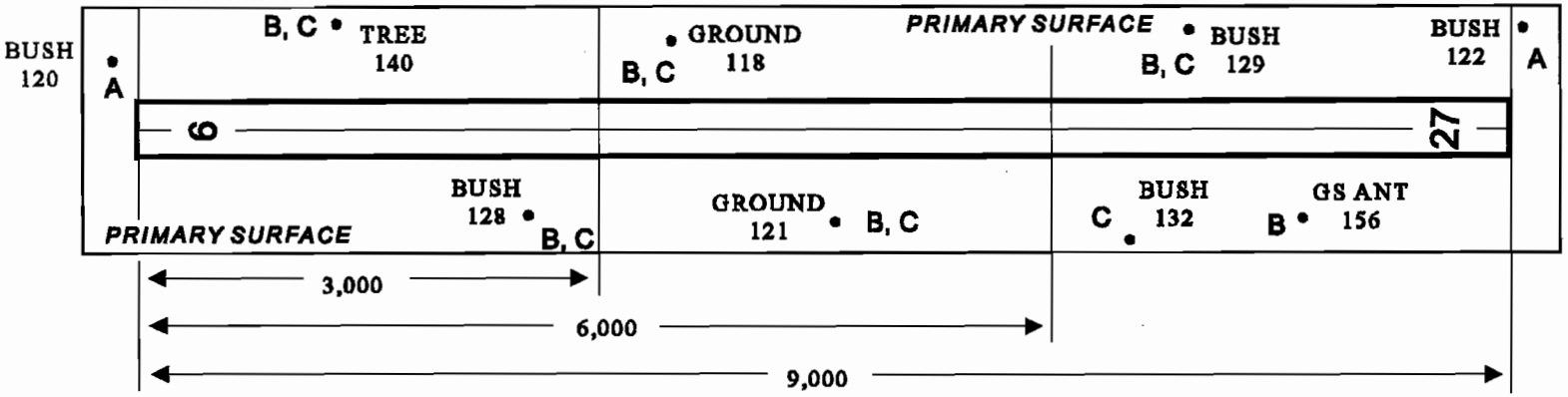
FAA NO. 405

OBSTRUCTION REPRESENTATION IN THE PRIMARY AREA SHALL INCLUDE THE:

A- HIGHEST OBSTRUCTION OUTWARD FROM THE RUNWAY END
B- HIGHEST OBSTRUCTION IN EACH 3,000 FOOT (APPROXIMATELY) PRIMARY SECTION ON EACH SIDE OF THE RUNWAY
C- HIGHEST NON-MANMADE OBSTRUCTION IN EACH 3,000 FOOT (APPROXIMATELY) PRIMARY SECTION ON EACH SIDE OF THE RUNWAY

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS.

SEE TEXT AND FIGURE 2.7 FOR OBSTRUCTING AREA REQUIREMENTS



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 2.3

OBSTRUCTION REPRESENTATION IN THE PRIMARY AREA

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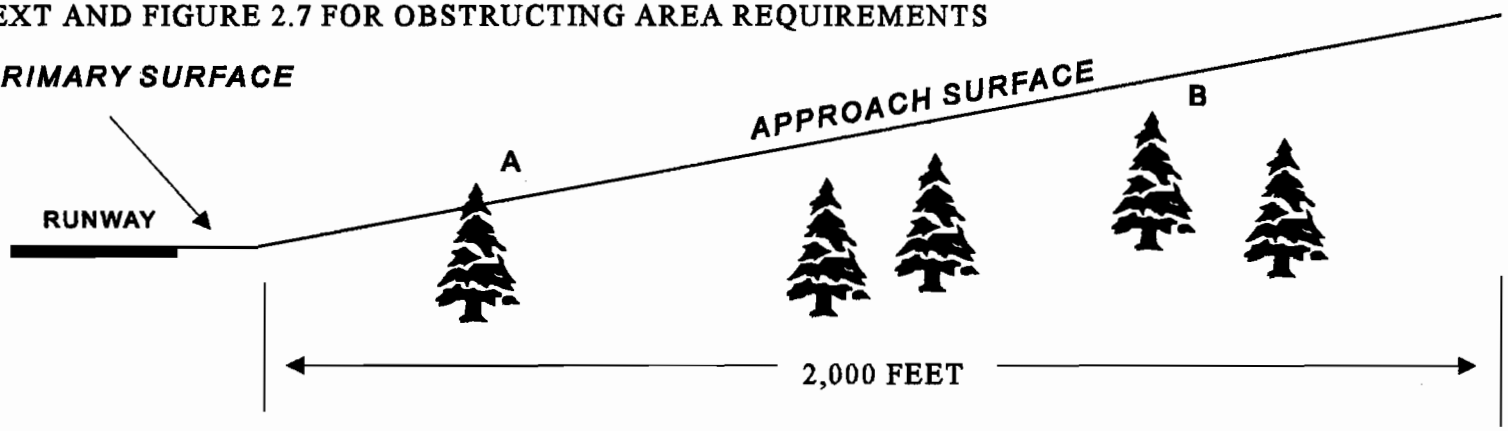
OBJECT REPRESENTATION IN THE FIRST 2,000 FEET
OF AN APPROACH AREA SHALL INCLUDE THE:

A- MOST PENETRATING OBSTRUCTION
B- HIGHEST OBJECT ABOVE THE RUNWAY END
(THIS OBJECT MAY NOT PENETRATE APPROACH)

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS

SEE TEXT AND FIGURE 2.7 FOR OBSTRUCTING AREA REQUIREMENTS



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 2.4

OBJECT REPRESENTATION IN THE FIRST 2,000 FEET OF AN APPROACH AREA

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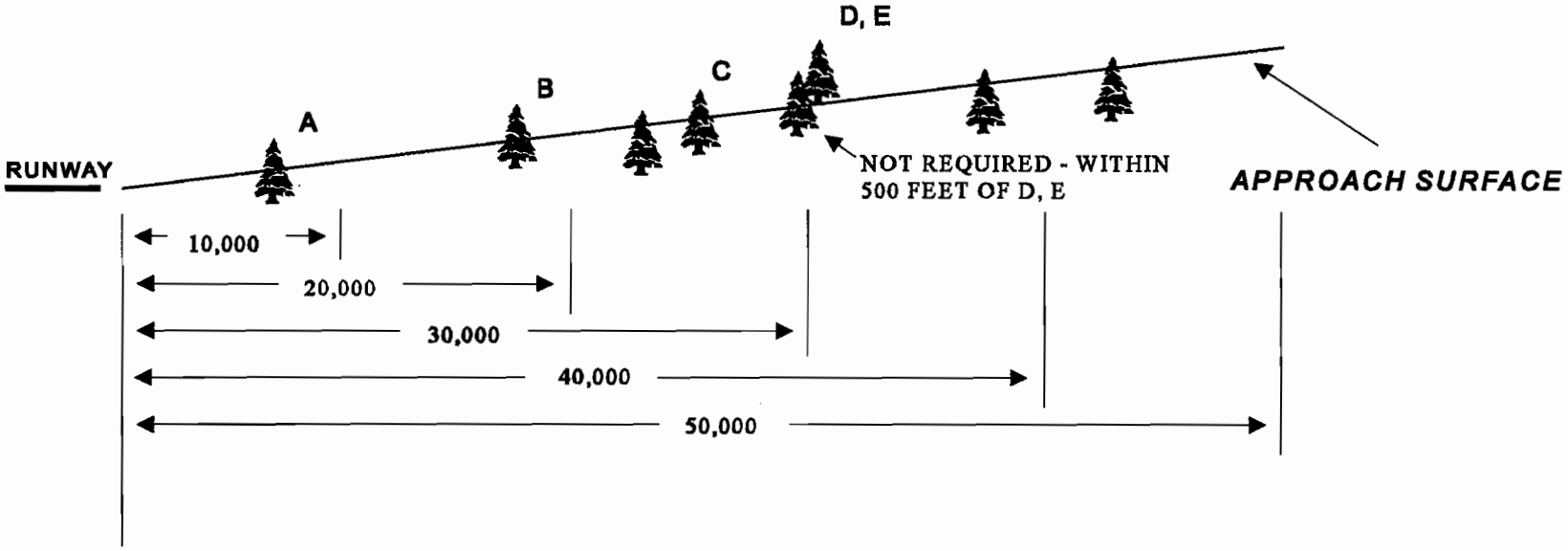
OBSTRUCTION REPRESENTATION IN AN APPROACH AREA SHALL INCLUDE THE HIGHEST APPROACH OBSTRUCTION IN THE:

A- FIRST 10,000 FEET OF THE APPROACH AREA
B- FIRST 20,000 FEET OF THE APPROACH AREA
C- FIRST 30,000 FEET OF THE APPROACH AREA
D- FIRST 40,000 FEET OF THE APPROACH AREA
E- APPROACH AREA

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS

SEE TEXT AND FIGURE 2.7 FOR OBSTRUCTING AREA REQUIREMENTS



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 2.5

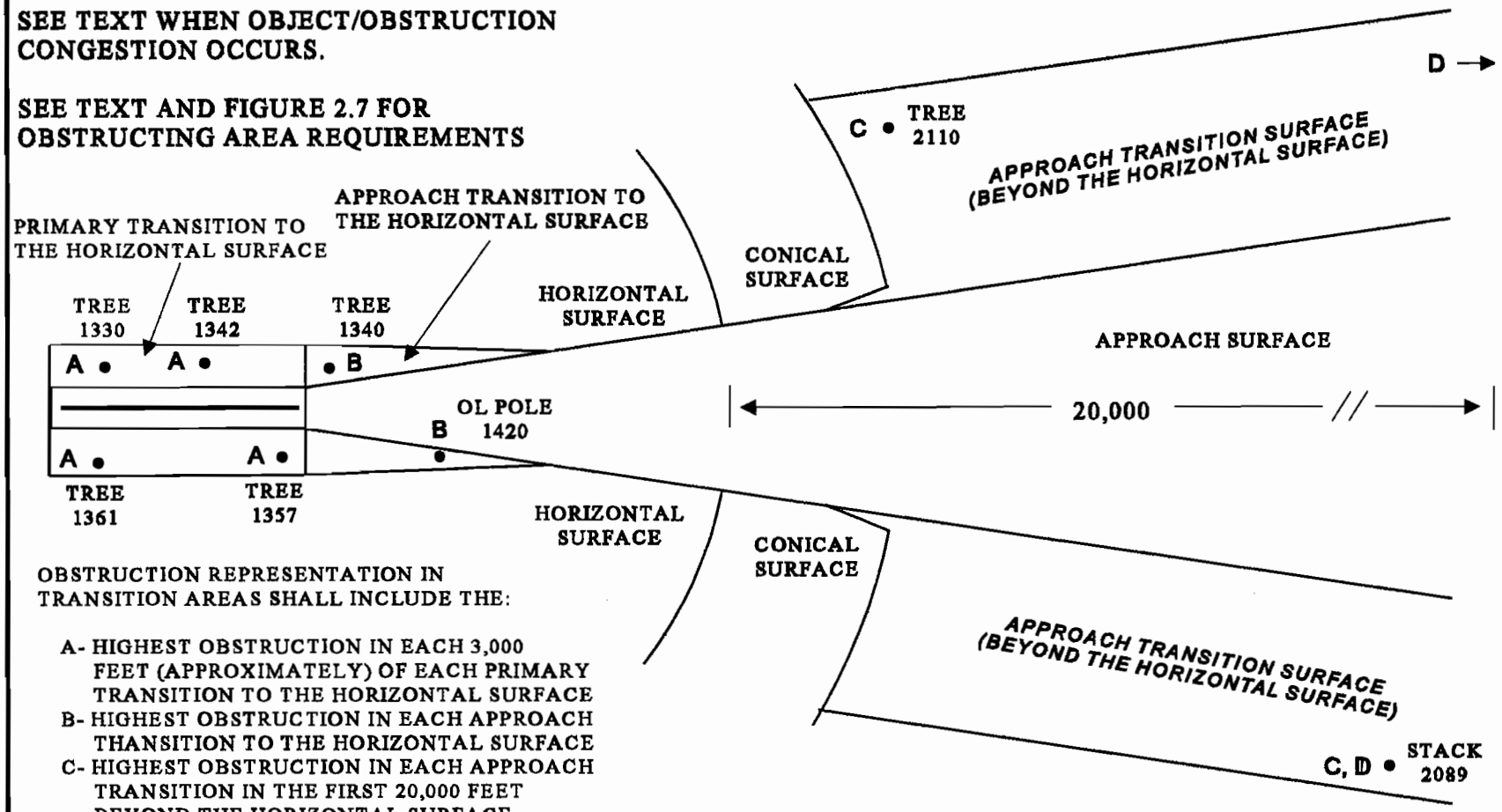
OBSTRUCTION REPRESENTATION IN AN APPROACH AREA

9/1/96

FAA NO. 405

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS.

SEE TEXT AND FIGURE 2.7 FOR OBSTRUCTING AREA REQUIREMENTS



OBSTRUCTION REPRESENTATION IN TRANSITION AREAS SHALL INCLUDE THE:

A- HIGHEST OBSTRUCTION IN EACH 3,000 FEET (APPROXIMATELY) OF EACH PRIMARY TRANSITION TO THE HORIZONTAL SURFACE
B- HIGHEST OBSTRUCTION IN EACH APPROACH THANSITION TO THE HORIZONTAL SURFACE
C- HIGHEST OBSTRUCTION IN EACH APPROACH TRANSITION IN THE FIRST 20,000 FEET BEYOND THE HORIZONTAL SURFACE
D- HIGHEST OBSTRUCTION IN EACH APPROACH TRANSITION BEYOND THE HORIZONTAL SURFACE

DIMENSIONS ARE IN FEET

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

FIGURE 2.6

NOT TO SCALE

OBJECT REPRESENTATION IN TRANSITION AREAS

9/1/96

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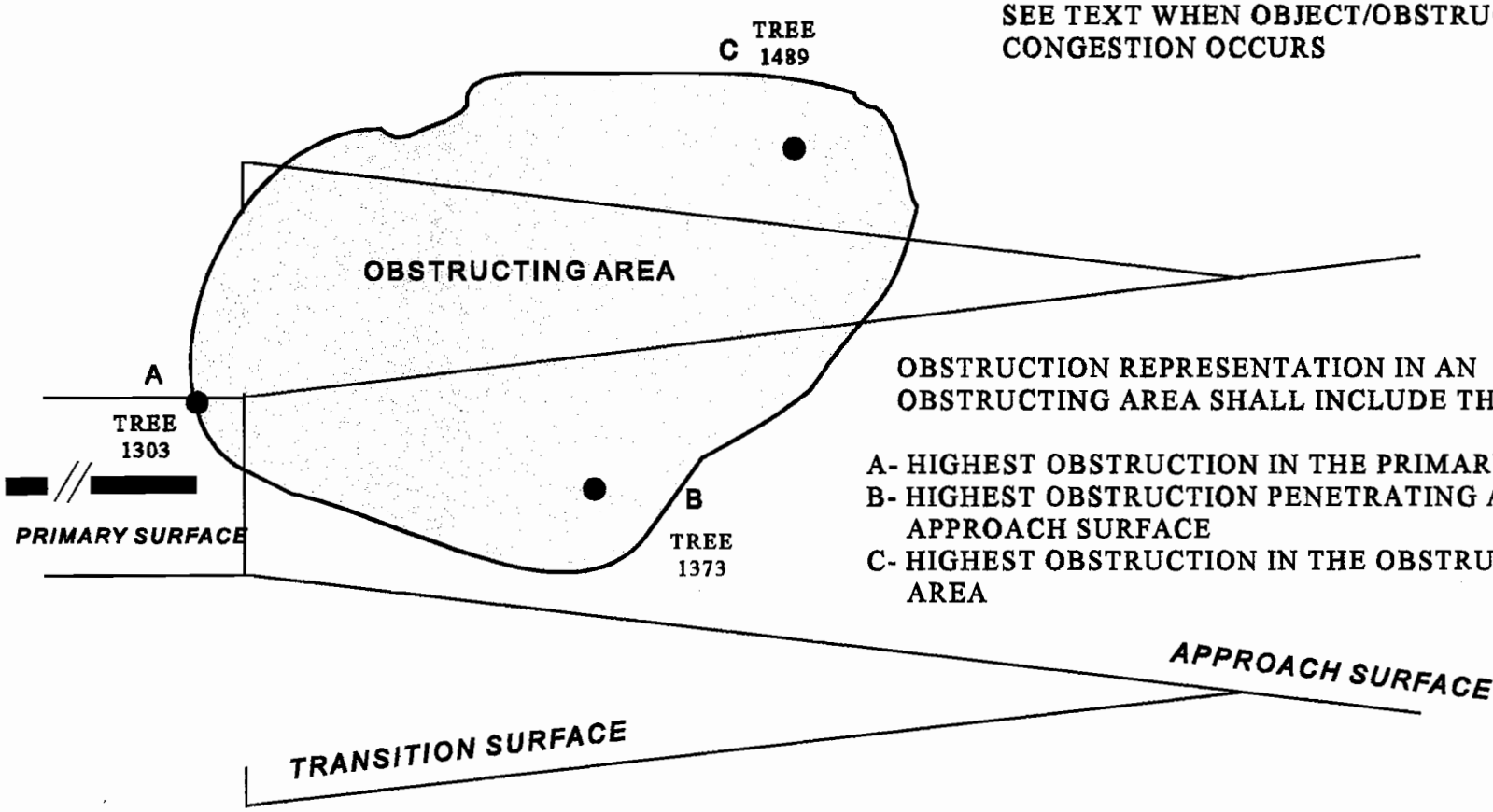

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS

OBSTRUCTION REPRESENTATION IN AN OBSTRUCTING AREA SHALL INCLUDE THE:

A- HIGHEST OBSTRUCTION IN THE PRIMARY AREA
B- HIGHEST OBSTRUCTION PENETRATING AN APPROACH SURFACE
C- HIGHEST OBSTRUCTION IN THE OBSTRUCTING AREA

DIMENSIONS ARE IN FEET

NOT TO SCALE

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

FIGURE 2.7

OBSTRUCTION REPRESENTATION IN OBSTRUCTING AREAS ON THE AIRPORT PLAN

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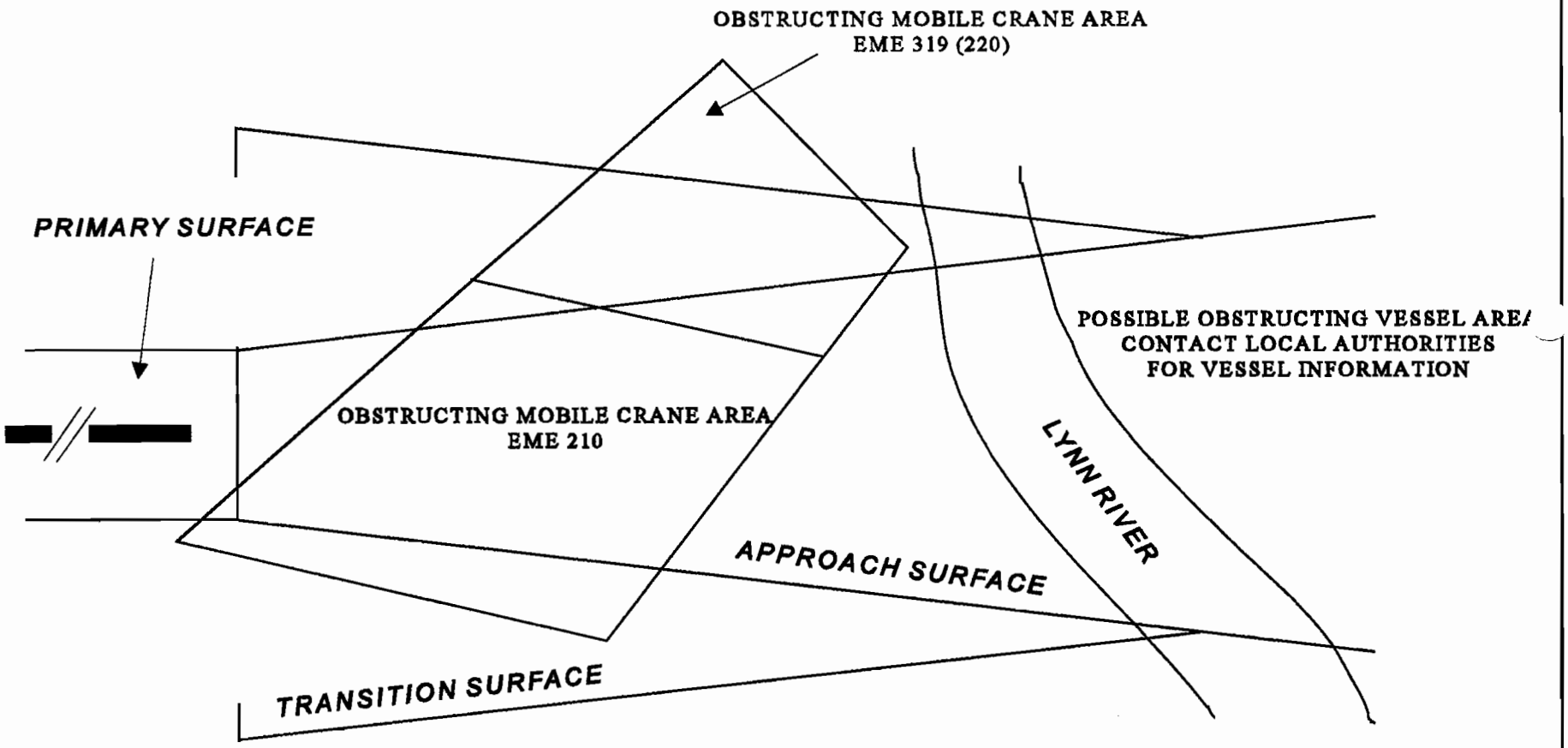

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

FIGURE 2.8

NOT TO SCALE

OBSTRUCTING VESSEL AND MOBILE OBJECT AREA DEPICTIONS AND ASSOCIATED NOTES ON THE AIRPORT PLAN

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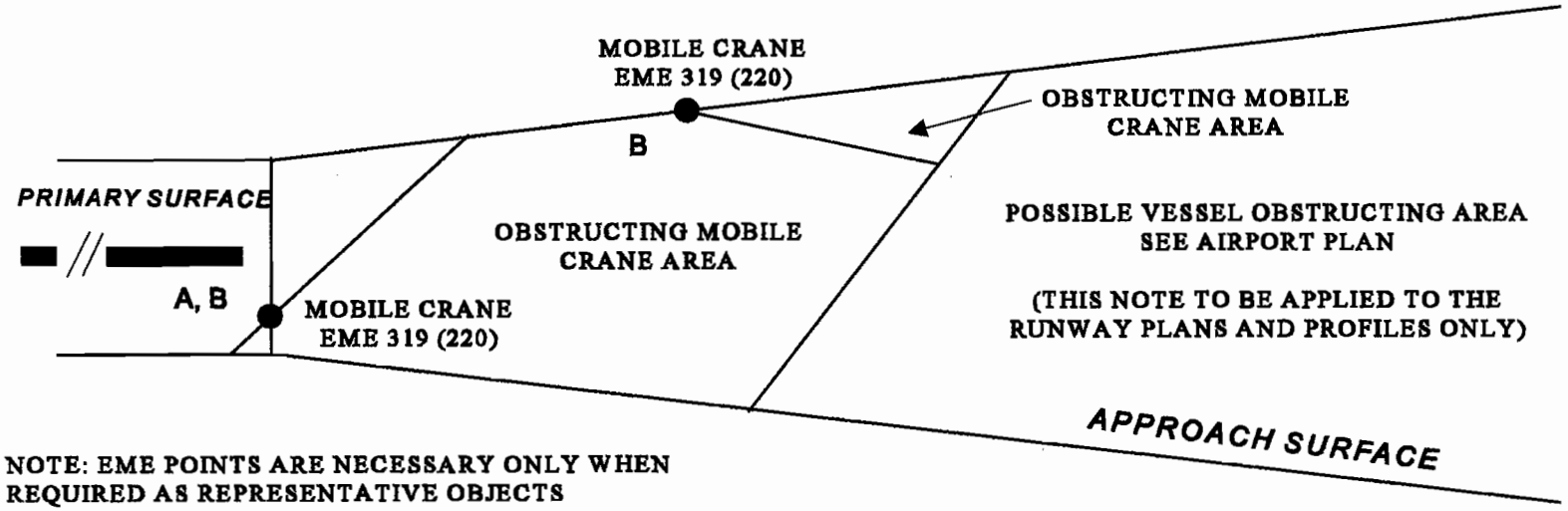
EME POINTS SHALL BE SELECTED FOR THE RUNWAY PLANS AND PROFILES AND AOC SURVEY DIGITAL PRODUCTS AT THE:

A- POINT NEAREST TO THE RUNWAY CENTERLINE END FOR PRIMARY SURFACE PENETRATIONS

B- MOST PENETRATING POINT FOR APPROACH SURFACE PENETRATIONS

C- AS APPROPRIATE TO REPRESENT THE AREA

AN EME POINT SHALL NOT BE CARRIED ON THE AIRPORT PLAN UNLESS IT IS THE HIGHEST OBJECT OUTWARD FROM THE RUNWAY END, IS HIGHER THAN THE RUNWAY END, AND IS LOCATED IN THE PRIMARY OR FIRST 2,000 FEET OF AN APPROACH.



NOTE: EME POINTS ARE NECESSARY ONLY WHEN REQUIRED AS REPRESENTATIVE OBJECTS

NOTE: AREA LIMITS ARE NOT SHOWN ON THE RUNWAY PLANS AND PROFILES. THEY ARE ILLUSTRATED HERE FOR ORIENTATION ONLY.

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

FIGURE 2.9

NOT TO SCALE

OBSTRUCTING VESSEL AND OBSTRUCTING MOBILE OBJECT AREA ESTIMATED MAXIMUM ELEVATION (EME) POINTS FOR RUNWAY PLANS AND PROFILES AND DIGITAL PRODUCTS

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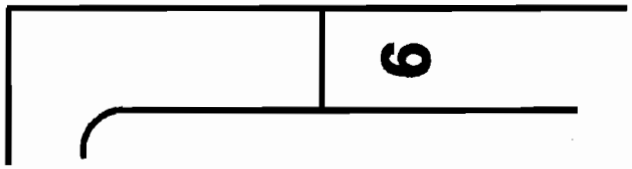
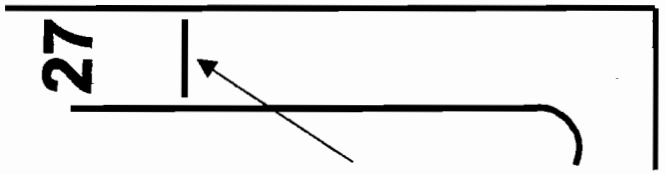
RELOCATED THRESHOLD

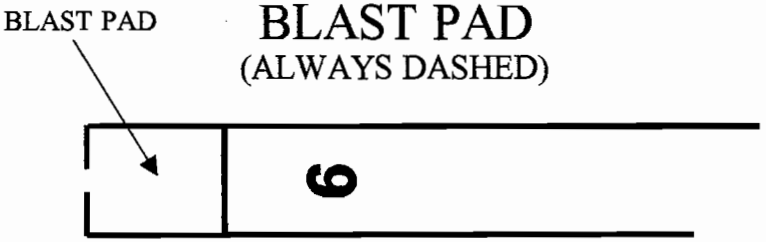


LEADERS MAY BE USED AS REQUIRED WITH BLAST PADS AND STOPWAYS - ALWAYS LEADER DISPLACED THRESHOLDS

DISPLACED THRESHOLD



BLAST PAD
(ALWAYS DASHED)



RUNWAY NUMBERS SHALL BE DEPICTED AS PAINTED ON THE RUNWAY AT THE TIME OF THE FIELD SURVEY. IF A NUMBER IS NOT PAINTED ON THE RUNWAY, THE RUNWAY NUMBER PUBLISHED IN THE "U.S. TERMINAL PROCEDURES" CURRENT THE TIME OF THE FIELD SURVEY WIL BE DEPICTED WITH THE BASE OF THE NUMBER APPROXIMATELY 100 FEET FROM THE THRESHOLD.

STOPWAY
(ALWAYS DASHED)

STOPWAY SURFACE TYPE SHALL BE LABELED "PAVED" FOR PAVED SURFACES AND "UNPAVED" FOR ALL OTHER SURFACE TYPES

DISPLACED THRESHOLD AND STOPWAY LENGTHS SHALL BE LABELED IN WHOLE FEET

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 2.10

THRESHOLD, STOPWAY, BLAST PAD, AND RUNWAY NUMBER DEPICTIONS ON THE AIRPORT PLAN

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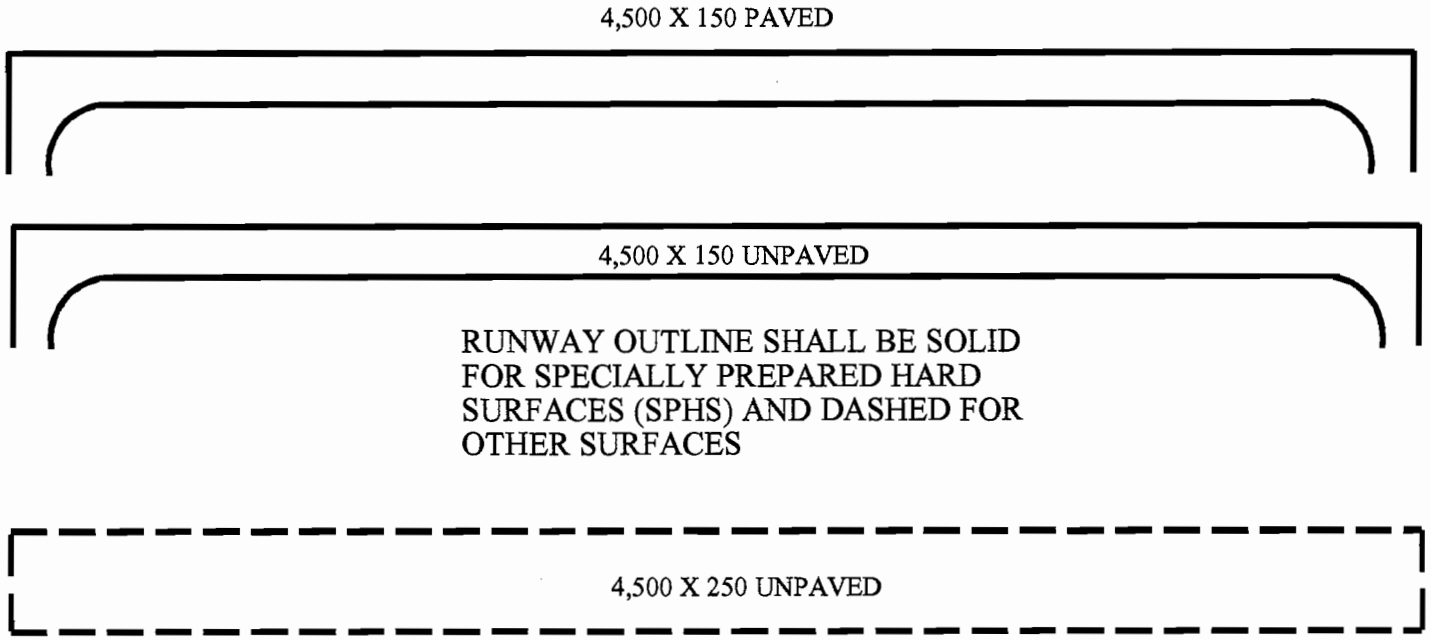
RUNWAY SURFACE TYPE SHALL BE LABELED "PAVED" FOR PAVED SURFACES AND "UNPAVED" FOR OTHER SURFACE TYPES

RUNWAY LENGTH AND WIDTH SHALL BE LABELED IN WHOLE FEET



FAR - 77 PRIMARY SURFACE ENDS 200 FEET BEYOND RUNWAY FOR SPHS RUNWAYS AND AT RUNWAY END FOR NON-SPHS RUNWAYS

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT AND STYLE SHEET OC 000 FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 2.11

RUNWAY LENGTH AND SURFACE TYPE DEPICTIONS ON THE AIRPORT PLAN

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This document has been divided into 2 parts for ease of downloading.
Refer to Part 2 to view the rest of this document.

SECTION 3

AREA NAVIGATION APPROACH (CONVENTIONAL LANDING) SURVEYS

SECTION 3
TABLE OF CONTENTS

AREA NAVIGATION APPROACH (CONVENTIONAL LANDING) SURVEYS

SUBSECTION **PAGE**

TABLE OF CONTENT CONT.

FIGURES

SECTION 3: AREA NAVIGATION APPROACH (CONVENTIONAL LANDING) SURVEYS

1. DESCRIPTION

Area Navigation Approach (ANA) surveys for conventional landing provide runway, obstruction, and other information to support precision and nonprecision instrument approach procedure development for conventional aircraft using area navigation systems, such as, GPS. In addition, these surveys provide positions and elevations for selected navigational aids (NAVAIDS) associated with the airport.

ANA surveys also establish (if it does not exist) geodetic control in the airport vicinity consisting of permanent survey marks accurately connected to the National Spatial Reference System (NSRS). This control and the NSRS connection assures accurate relativity between surveyed points on the airport and between these points and other surveyed points in the National Airspace System (NAS), including the navigation satellites. In addition, this control supports not only ANA surveys, but also future engineering activities, such as, runway/taxiway construction, NAVAID siting, obstruction clearing, road building, and other airport related projects.

2. DATUM TIE AND LOCAL CONTROL

Datum tie and local control requirements for all surveys accomplished in accordance with FAA No. 405 standards are identified in Appendix 3.

3. ACCURACIES

Accuracy requirements for all data provided in accordance with FAA No. 405 standards are identified in Appendix 5.

4. RUNWAY AND STOPWAY POINTS

Runway/stopway data shall be provided for all runways and stopways with a specially prepared hard surface (SPHS) existing at the time of the field survey. Data shall be provided for non-SPHS runways only if specifically requested by appropriate Federal Aviation Administration authorities. Data shall be provided for non-SPHS stopways if the stopway was officially designated a stopway by appropriate airport authorities.

Unless otherwise stated, all runway/stopway points shall be on the runway/stopway centerline.

Runways shall be identified by the number painted on the runway at the time of the field survey. If a number is not painted on the runway, the runway number published in the "U.S. Terminal Procedures" current at the time of the field survey shall be used.

4.1. REQUIRED DATA FOR RUNWAYS AND STOPWAYS

Required data for SPHS and Non-SPHS runways and stopways are presented in Table 3.1. (Also see Figure 3.1).

TABLE 3.1
REQUIRED RUNWAY/STOPWAY DATA

RWY/STWY POINT	REQUIRED DATA SPHS RWY	NON-SPHS RWY
AIRPORT ELEV	D/E	D/E
RUNWAY ENDS	P/E	P/N
INTERSECTION OF SPHS RWYS	D/E	N/N
DISPLACED THLDS	P/E	P/E*
TOUCHDOWN ZONE	N/E	N/N
STOPWAY ENDS	D/E	D/E
SUPPLEMENTAL PROFILE POINTS	D/E	N/N
POINT ABEAM GS	P/E	N/N
POINT ABEAM MLSEL	P/E	N/N
POINT ABEAM OFFSET LOC	P/N	N/N
POINT ABEAM OFFSET LDA	P/N	N/N
POINT ABEAM OFFSET SDF	P/N	N/N
POINT ABEAM OFFSET MLSAZ	P/N	N/N

ELEVATION REQUIRED ONLY IF AN OBSTRUCTION SURVEY WAS PERFORMED
D = DISTANCE FROM RUNWAY'S : (1) NEAR END FOR AIRPORT ELEVATION, (2) APPROACH END FOR RUNWAY INTERSECTIONS AND SUPPLEMENTAL PROFILE POINTS, AND (3) STOP END FOR STOPWAYS
E = ELEVATION
N = POSITION, DISTANCE, OR ELEVATION NOT REQUIRED
P = LATITUDE AND LONGITUDE

A FACILITY IS CONSIDERED OFFSET IF LOCATED MORE THAN 10 FEET FROM THE RUNWAY CENTERLINE/CENTERLINE EXTENDED.

5. NAVIGATIONAL AIDS

ELECTRONIC NAVAIDS

A position, and sometimes an elevation, depending on the navigational aid (NAVAID), shall be determined for selected electronic NAVAIDS associated with the airport. The horizontal and vertical survey points for electronic NAVAIDS are listed in Appendix 4.

Survey data is required for NAVAIDS meeting all of the following three criteria:

- The NAVAID is listed in Appendix 4.

- The NAVAID is located within 10 nautical miles of the Airport Reference Point.

- The NAVAID is associated with an instrument approach procedure for the airport being surveyed and the procedure is published in the United States Government flight information publication "U.S. Terminal Procedures" current at the time of the field survey. This requirement also applies to Airport Surveillance Radars.

If the NAVAID is also an obstruction, the obstruction requirements of Subsection 6 of this section also apply.

VISUAL NAVAIDS

Visual NAVAIDS are not required.

6. OBSTRUCTIONS

6.1. DEFINITION

An obstruction, for purposes of this section, is any object that penetrates an ANA obstruction identification surface (OIS).

6.2. OBSTRUCTION IDENTIFICATION SURFACES

PRECISION ANA

OIS dimensions for precision ANA surveys are presented in Table 3.2 through Table 3.5. and Figure 3.2 and Figure 3.3.

TABLE 3.2

PRIMARY SURFACE
PRECISION AREA NAVIGATION APPROACH

BEGINS	200 FT. ON APPROACH SIDE OF THRESHOLD
LENGTH	DISTANCE BETWEEN RUNWAY THRESHOLDS PLUS 400 FT.
WIDTH AT THRESHOLD	1,000 FT.
WIDTH AT THRESHOLD PLUS 200 FT.	1,000 FT.
SLOPE	SEE "ELEVATION" BELOW
ELEVATION	BETWEEN THRESHOLDS - ELEVATION OF NEAREST POINT ON RUNWAY CENTERLINE
	BEYOND THRESHOLD - ELEVATION OF RUNWAY CENTERLINE AT THRESHOLD

THE PRIMARY SURFACE IS A 1,000 FOOT WIDE RECTANGLE CENTERED ON THE RUNWAY CENTERLINE, BEGINNING 200 FEET ON THE APPROACH SIDE OF A RUNWAY THRESHOLD AND EXTENDING TO 200 FEET ON THE APPROACH SIDE OF THE OPPOSITE RUNWAY THRESHOLD.

TABLE 3.3

APPROACH SURFACE
PRECISION AREA NAVIGATION APPROACH

BEGINS	200 FT. ON APPROACH SIDE OF THRESHOLD (AT END OF PRIMARY SURFACE)
LENGTH	50,000 FT.
BEGINNING WIDTH	800 FT.
WIDTH AT 50,000 FT.	4,400 FT.
SLOPE	50:1 FOR FIRST 2,566 FT. THEN 34:1 TO END OF APPROACH SURFACE
ELEVATION AT BEGINNING	ELEVATION OF THRESHOLD
ELEVATION AT 2,566 FT.	51.3 FT. ABOVE THRESHOLD
ELEVATION AT 50,000 FT.	1,446.4 FT. ABOVE THRESHOLD

THE APPROACH SURFACE IS CENTERED ON THE RUNWAY CENTERLINE/CENTERLINE EXTENDED.

TABLE 3.4

APPROACH TRANSITION SURFACE
PRECISION AREA NAVIGATION APPROACH

BEGINS	200 FT. ON APPROACH SIDE OF THRESHOLD
LENGTH	50,000 FT.
BEGINNING WIDTH	600 FT. (EACH SIDE OF APPROACH SURFACE)
WIDTH AT 50,000 FT.	6,376 FT. (EACH SIDE OF APPROACH SURFACE)
SLOPE	7:1 PERPENDICULAR TO RUNWAY CENTERLINE/CENTERLINE EXTENDED
TOP ELEVATION AT BEGINNING	85.7 FT. ABOVE THRESHOLD
TOP ELEVATION AT 2,566 FT.	179.4 FT. ABOVE THRESHOLD
TOP ELEVATION AT 50,000 FT.	2,357.3 FT. ABOVE THRESHOLD

TRANSITION SURFACES EXISTS ALONG THE ENTIRE LENGTH, AND ON EACH SIDE, OF THE APPROACH SURFACE. THE WIDTH AND SLOPE ARE MEASURED PERPENDICULAR TO THE RUNWAY CENTERLINE/CENTERLINE EXTENDED.

TABLE 3.5

MISSED APPROACH SURFACE
PRECISION AREA NAVIGATION APPROACH

BEGINS	1,300 FT. ON APPROACH SIDE OF THRESHOLD
LENGTH	7,800 FT.
BEGINNING WIDTH	2,333.3 FT.
WIDTH AT 7,800 FT.	6,200 FT.
SLOPE	40:1
ELEVATION AT BEGINNING	22 FT. ABOVE THRESHOLD
ELEVATION AT 7,800 FT.	217 FT. ABOVE THRESHOLD

THE MISSED APPROACH SURFACE IS CENTERED ON THE RUNWAY CENTERLINE/CENTERLINE EXTENDED.

NONPRECISION ANA

OIS dimensions for nonprecision ANA surveys are presented in Table 3.6 and Figure 3.4.

TABLE 3.6

APPROACH SURFACE
NONPRECISION AREA NAVIGATION APPROACH

BEGINS	TO BE DEVELOPED
LENGTH	TO BE DEVELOPED
WIDTH AT BEGINNING	TO BE DEVELOPED
WIDTH AT END	TO BE DEVELOPED
SLOPE	TO BE DEVELOPED
ELEVATION AT BEGINNING	TO BE DEVELOPED
ELEVATION AT END	TO BE DEVELOPED

6.3. SPECIAL CASES

- Catenaries

In most cases, the position and elevation of supporting towers will adequately represent catenaries. These towers shall be treated as any other potential obstruction. However, if one, or both, towers are outside the limits of the obstruction surface, the catenary itself may become a significant obstruction. In these cases, a position and elevation shall be provided on the imaginary straight line connecting the tops of the two adjacent catenary support towers at the highest point within the obstruction surface. The elevation of this point shall be carried as an estimated maximum elevation (EME).

- Vehicular Traverse Ways

In general, a vehicular traverse way shall be treated as any other obstruction, except that the appropriate vehicle height allowance must be included in the elevation. (See "Obstruction Exemptions" in this subsection for possible exemptions that may apply to vehicular traverse ways).

Vehicle Height Allowances follow:

Noninterstate roads	15 feet
Interstate roads	17 feet
Railroads	23 feet

- Mobile Obstructions

Representative obstructions that are mobile within a defined area (except vehicles on roads and railroads, and vessels which are treated under separate headings) shall have an estimated maximum elevation (EME) determined for each area. EME points shall be selected at: (1) the point nearest to the runway centerline at the threshold for primary surface penetrations, (2) the most penetrating point for approach surface penetrations, and (3) as appropriate to represent each mobile object area. (See Figure 3.10)

The word "MOBILE," which always implies an EME, shall be included in the object name, such as, "MOBILE CRANE."

- Obstructions Under Construction

Representative obstructions that are under construction shall be identified as being under construction, such as, "BUILDING UNDER CONSTRUCTION." The elevation at the time of the survey shall be carried. However, if a construction crane extends above the feature under construction, it is necessary and sufficient to carry the elevation and position of the crane.

- Vessels

Because of uncertainties in determining maximum vessel heights, travel limits, and frequency of passage, vessel heights and locations shall not be provided. However, if a possible obstructing condition exists, an obstructing vessel caution shall be provided on ANA survey products cautioning that vessels may obstruct at certain times and that further investigation by the data user regarding maximum vessel height, travel limits, and frequency of passage is advised. This exemption does not apply to vessels that are permanently moored.

- Manmade Objects Equal to or Greater than 200 Feet Above Ground Level (AGL)

The AGL elevation shall be determined for manmade objects equal to, or greater than, 200 feet AGL. The AGL shall be measured from the highest point of ground in contact with either the object or the structure on which the object rests. This AGL requirement applies only to representative objects that normally would be carried on ANA survey products and does not necessarily require measuring all 200+ AGL manmade objects in the survey area.

- Obstruction Exemptions

The following obstructions are not required to be measured or carried on ANA Conventional Landing products:

- Vegetation that is both obstructing by less than three feet and with a maximum cross sectional diameter no greater than one-half inch where transected by an obstruction surface.

- Annual vegetation, such as annual weeds, corn, millet, and sugar cane.

- Frangible objects under the control of airport authorities with locations fixed by function. Examples are runway and taxiway signs, and many approach light structures.

- Roads with restricted public access that are intended for airport/facility maintenance only. This exemption does not apply to airport service roads associated with other airport operations, such as, food, fuel, and freight transportation.

- Construction equipment and debris, including dirt piles and batch plants, that are: (1) temporary in nature, (2) under the control of airport authorities, and (3) located on airport property.

- Vessels. However, if a possible obstructing condition exists, an obstructing vessel caution shall be provided on ANA survey products cautioning that vessels may obstruct at certain

times and that further investigation by the data user regarding maximum vessel height, travel limits, and frequency of passage is advised. This exemption does not apply to vessels that are permanently moored.

- Parked aircraft. The location and maximum elevation of individual parked aircraft cannot be determined and shall not be provided under ANA surveys. This exemption does not apply to aircraft that are permanently parked for display purposes.

6.4. SELECTION

Obstruction selection shall include a representation of objects that penetrated ANA OIS's at the time of the field survey. In addition, certain nonobstructing objects may be required in the first 2,566 feet of the approach area. The special cases that apply to obstructions (see Subsection 6.3) also apply to these required nonobstructing objects.

Required objects/obstructions include:

- Primary Surface (See Figure 3.5)

The highest obstruction on the approach side of the threshold.

In addition, for Category II and Category III approaches, the highest obstruction on each side of the runway centerline and between thresholds shall be determined. This requirement is in effect only when the approach has been specifically identified as a Category II or Category III by appropriate FAA authorities.

- Precision Approach Surfaces (See Figure 3.6 and Fig. 3.7)

The two most penetrating obstructions and the most penetrating man-made obstruction in the first 2,566 feet of an approach area.

The two highest objects that are within the first 2,566 feet of an approach area and also higher than the threshold. These objects may or may not penetrate the approach surface and may be nonobstructing EME points.

The highest obstruction between 2,566 feet and 10,000 feet of an approach area. This area is the first 7,434 feet of the 34:1 slope area.

The highest obstruction in the first 20,000 feet, in the first 30,000 feet, and in the first 40,000 feet of an approach area.

The highest obstruction in the approach area.

- Nonprecision Approach Surface (See Figure 3.4)

TO BE DEVELOPED

- Transition Surfaces (See Figure 3.8)

The two highest obstruction in the first 2,566 feet (as measured along the runway centerline or centerline extended) of each transition area.

The highest obstruction in the first 10,000 feet, in the first 20,000 feet, in the first 30,000 feet, and in the first 40,000 feet of the each transition area.

The highest obstruction in each transition area.

- Missed Approach Surface (See Figure 3.9)

The highest obstruction and the most penetrating obstruction on each side of the runway centerline or centerline extended.

Note: obstructions may be EME points for obstructing mobile object areas. (See Figure 3.10)

In some cases, strict adherence to the object selection criteria listed above may result in congestion or inadequate obstruction representation. To minimize these situations, the following guidelines shall be followed in object selection:

- If objects that are required in the primary area or first 10,000 feet of an approach area are located within 100 feet of each other, the lower object may be omitted.

- If objects that are required outside the primary or first 10,000 of an approach area are located within 500 feet of each other, the lower object may be omitted. (Note: required primary or approach objects shall not be omitted because of the close proximity of higher objects outside of the primary or approach areas).

- When a required object is omitted because of congestion, a replacement object/objects shall be selected if possible that meets the spacing criteria.

- Occasionally, additional obstruction information may be useful in representing certain obstructing conditions. While rigorous selection criteria is not practical, information useful to obstruction clearing activities should be considered in the selection.

7. PLANIMETRIC DETAIL

Planimetric detail is not required.

8. METEOROLOGICAL APPARATUS

Meteorological apparatus data is not required unless it is selected as a representative obstruction.

9. MISCELLANEOUS

AIRPORT REFERENCE POINT

The Airport Reference Point (ARP) shall be computed using the centerline end positions of all usable runways. However, since runways without specially prepared hard surfaces are often not required to be surveyed, the ARP position for these airports shall be approximate. The ARP shall be tagged with the year of the most recent runway end survey used in the ARP computation, such as, "ARP (1995)."

Procedures for computing ARP are presented in Appendix 2.

10. DATA DELIVERY

ANA survey data shall be furnished in the Universal Data Delivery Format (UDDF). The UDDF is described in Appendix 1.

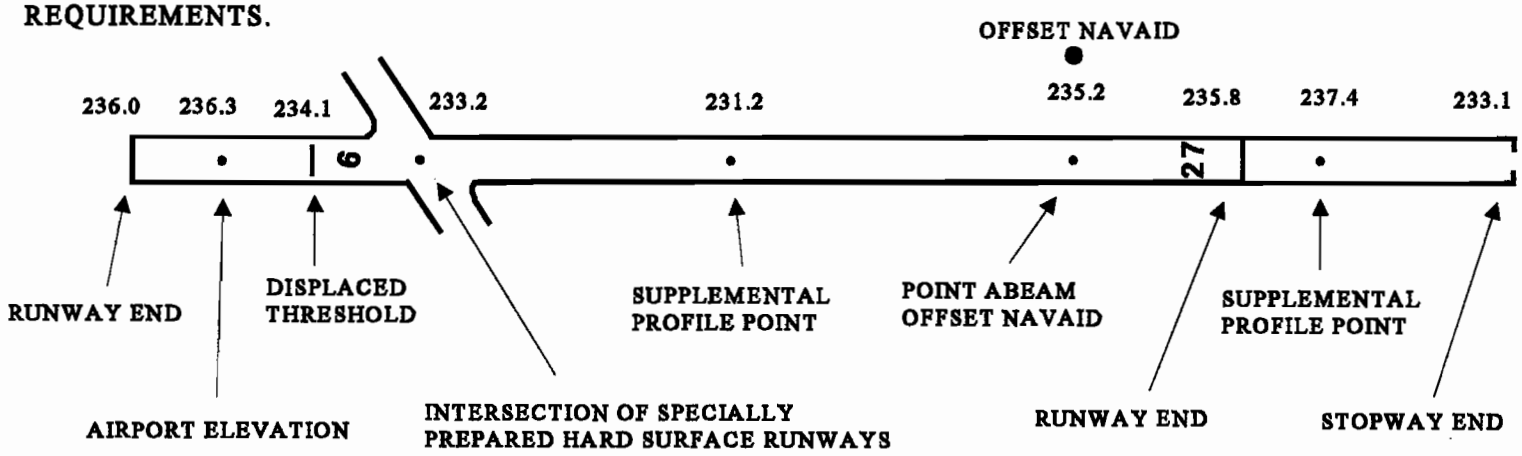
POSITIONS AND/OR ELEVATIONS (SEE TABLE 3.1) SHALL BE PROVIDED FOR: (1) RUNWAY ENDS, (2) DISPLACED THRESHOLDS, (3) TOUCHDOWN ZONES (ELEV ONLY), (4) RUNWAY INTERSECTIONS, (5) AIRPORT ELEVATION, (6) POINT ABEAM CERTAIN OFFSET NAVAIDS, AND (7) STOPWAY ENDS.

TOUCHDOWN ZONE ELEVATIONS ARE REQUIRED ONLY FOR SPECIALLY PREPARED HARD SURFACE RUNWAYS WITH A USABLE LANDING LENGTH OF AT LEAST 3,000 FEET.

SEE TEXT AND TABLE 3.1 FOR NON-SPECIALLY PREPARED HARD SURFACE RUNWAY/STOPWAY REQUIREMENTS.

POSITIONS AND ELEVATIONS SHALL ALSO BE PROVIDED FOR SUPPLEMENTAL PROFILE POINTS, SELECTED SO THAT A STRAIGHT LINE BETWEEN ANY TWO ADJACENT PUBLISHED RUNWAY/STOPWAY POINTS WILL BE NO GREATER THAN ONE FOOT FROM THE RUNWAY/STOPWAY SURFACE.

RUNWAYS SHALL BE IDENTIFIED BY THE NUMBER PAINTED ON THE RUNWAY AT THE TIME OF THE FIELD SURVEY. IF A NUMBER IS NOT PAINTED ON THE RUNWAY, THE RUNWAY NUMBER PUBLISHED IN THE "U.S. TERMINAL PROCEDURES" CURRENT AT THE TIME OF THE FIELD SURVEY SHALL BE USED.



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

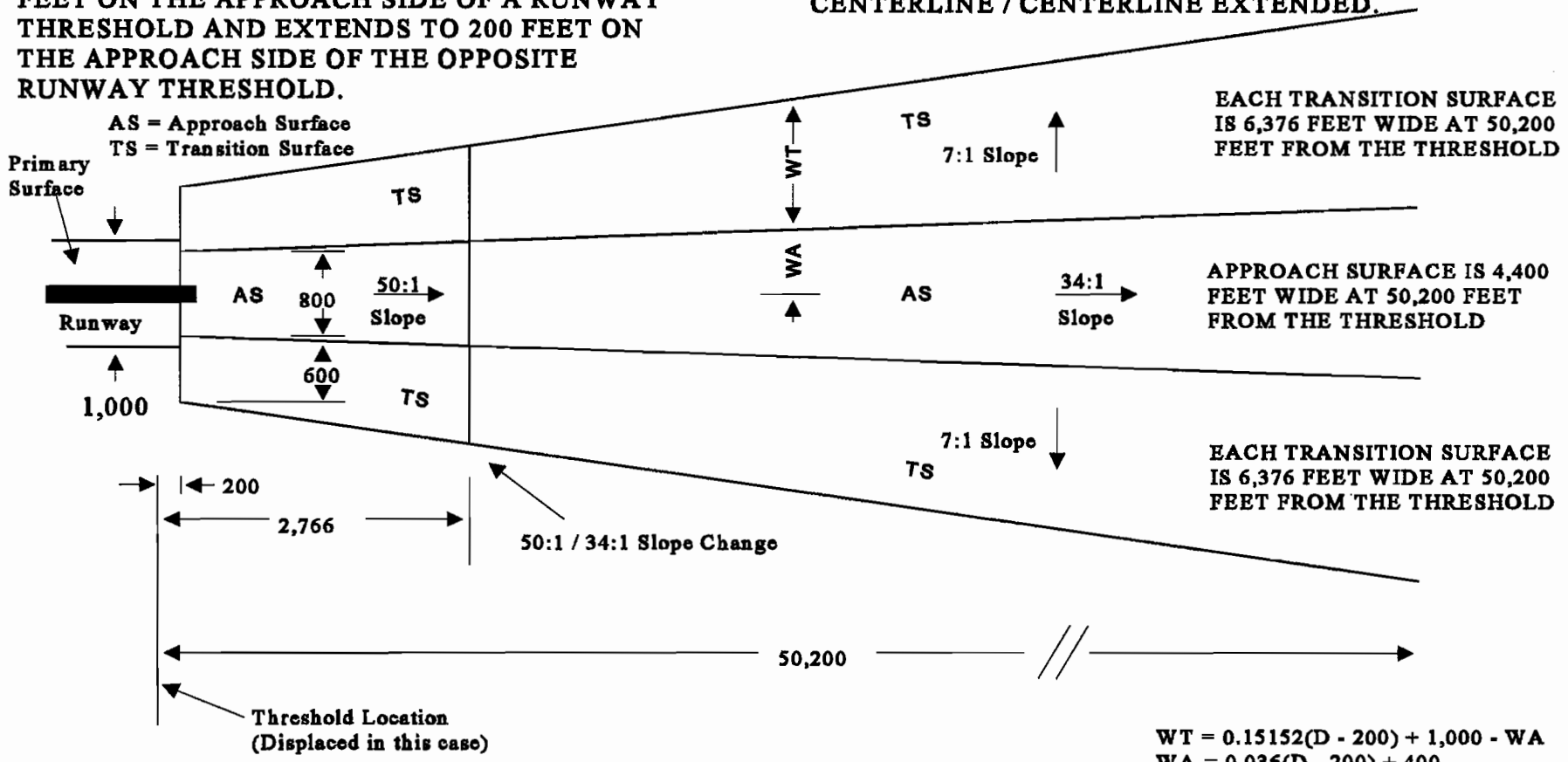
NOT TO SCALE

FIGURE 3.1

RUNWAY NUMBERS AND REQUIRED POINTS FOR SPECIALLY PREPARED HARD SURFACE RUNWAYS/STOPWAYS

THE PRIMARY SURFACE IS 1,000 FEET WIDE. RECTANGULAR IN SHAPE, AND CENTERED ON THE RUNWAY CENTERLINE. IT BEGINS 200 FEET ON THE APPROACH SIDE OF A RUNWAY THRESHOLD AND EXTENDS TO 200 FEET ON THE APPROACH SIDE OF THE OPPOSITE RUNWAY THRESHOLD.

TRANSITION SURFACES ARE ADJACENT TO THE APPROACH SURFACE. WIDTH AND SLOPE ARE MEASURED PERPENDICULAR TO THE RUNWAY CENTERLINE / CENTERLINE EXTENDED.



WT = 0.15152(D - 200) + 1,000 - WA
WA = 0.036(D - 200) + 400
Where: D = Distance from Threshold as Measured along Approach Centerline

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

FIGURE 3.2

NOT TO SCALE

OBSTRUCTION INDENTIFICATION SURFACES PRECISION APPROACH, PRIMARY, AND TRANSITIONS

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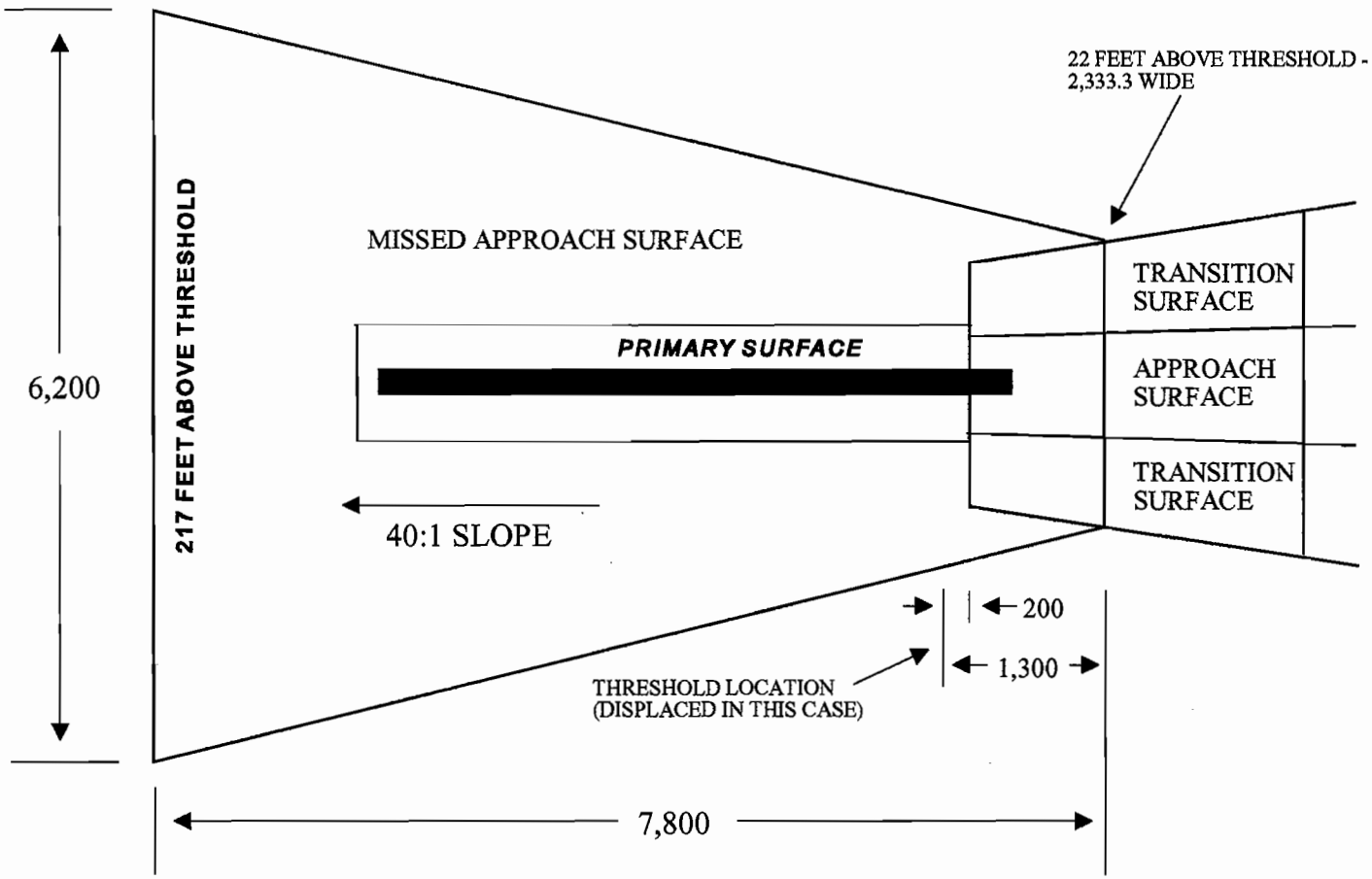

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DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 3.3

OBSTRUCTION IDENTIFICATION SURFACE MISSED PRECISION APPROACH

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TO BE DEVELOPED

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NOT TO SCALE

DIMENSIONS ARE IN FEET

FIGURE 3.4

OBSTRUCTION IDENTIFICATION SURFACES NONPRECISION APPROACH

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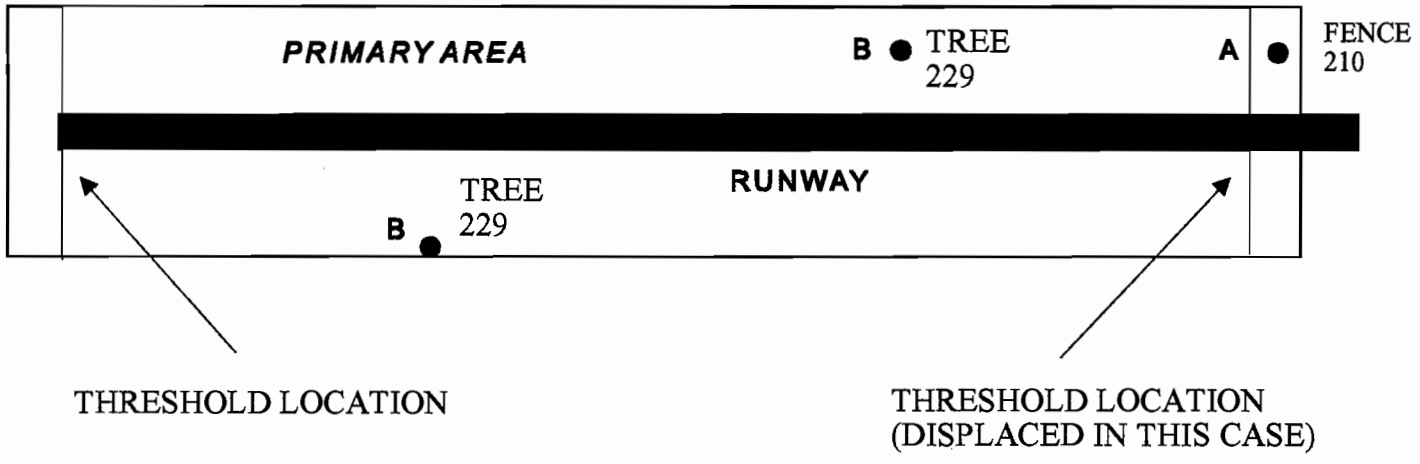
OBSTRUCTION REPRESENTATION IN THE PRIMARY AREA SHALL INCLUDE THE:

A- HIGHEST OBSTRUCTION ON THE APPROACH SIDE OF THE THRESHOLD
B- HIGHEST OBSTRUCTION ON EACH SIDE OF THE RUNWAY CENTERLINE AND BETWEEN THRESHOLDS. THIS REPRESENTATION IS REQUIRED ONLY FOR CATEGORLY II AND III APPROACHES.

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS.



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

NOT TO SCALE

DIMENSIONS ARE IN FEET

FIGURE 3.5

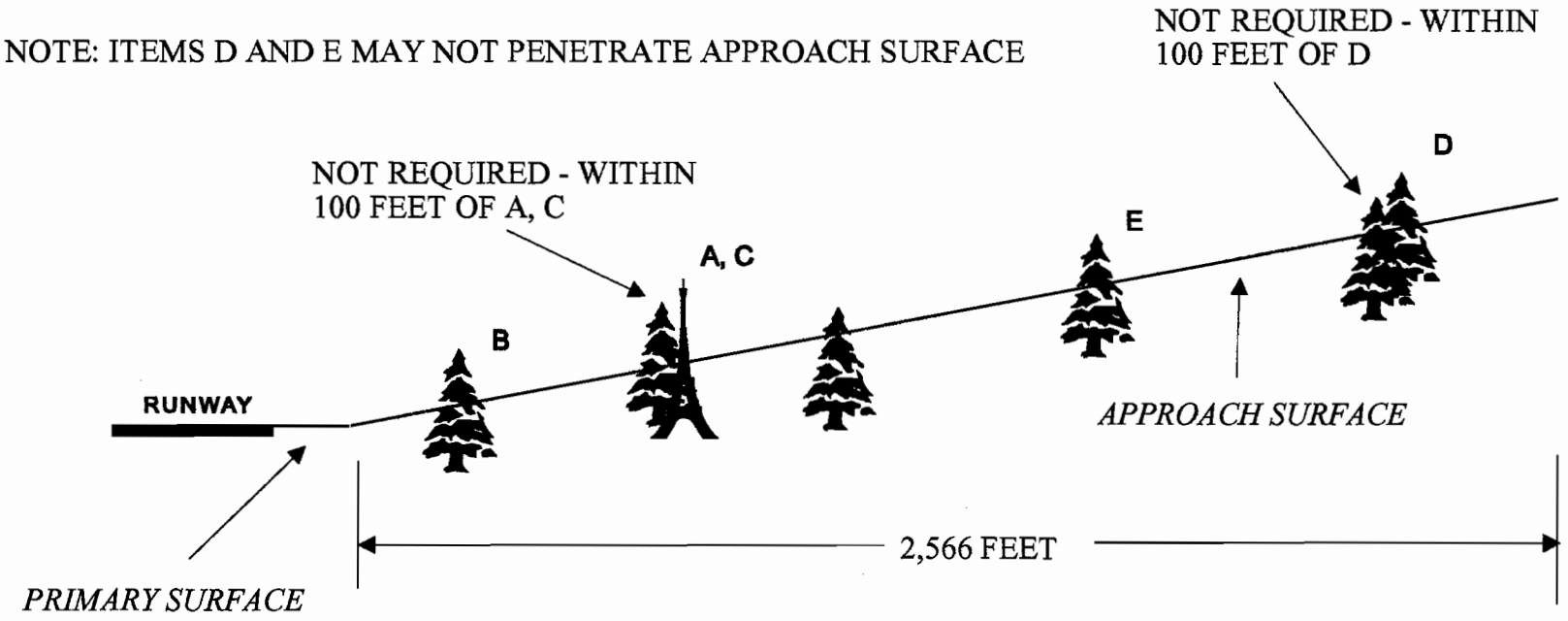
OBSTRUCTION REPRESENTATION IN THE PRIMARY AREA

OBJECT REPRESENTATION IN THE FIRST 2,566 FEET OF A PRECISION APPROACH AREA SHALL INCLUDE THE:

A- MOST PENETRATING OBSTRUCTION
B- SECOND MOST PENETRATING OBSTRUCTION
C- MOST PENETRATING MAN-MADE OBSTRUCTION
D- HIGHEST OBJECT ABOVE THE THRESHOLD
E- SECOND HIGHEST OBJECT ABOVE THE THRESHOLD

NOTE: ITEMS D AND E MAY NOT PENETRATE APPROACH SURFACE

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

NOT TO SCALE

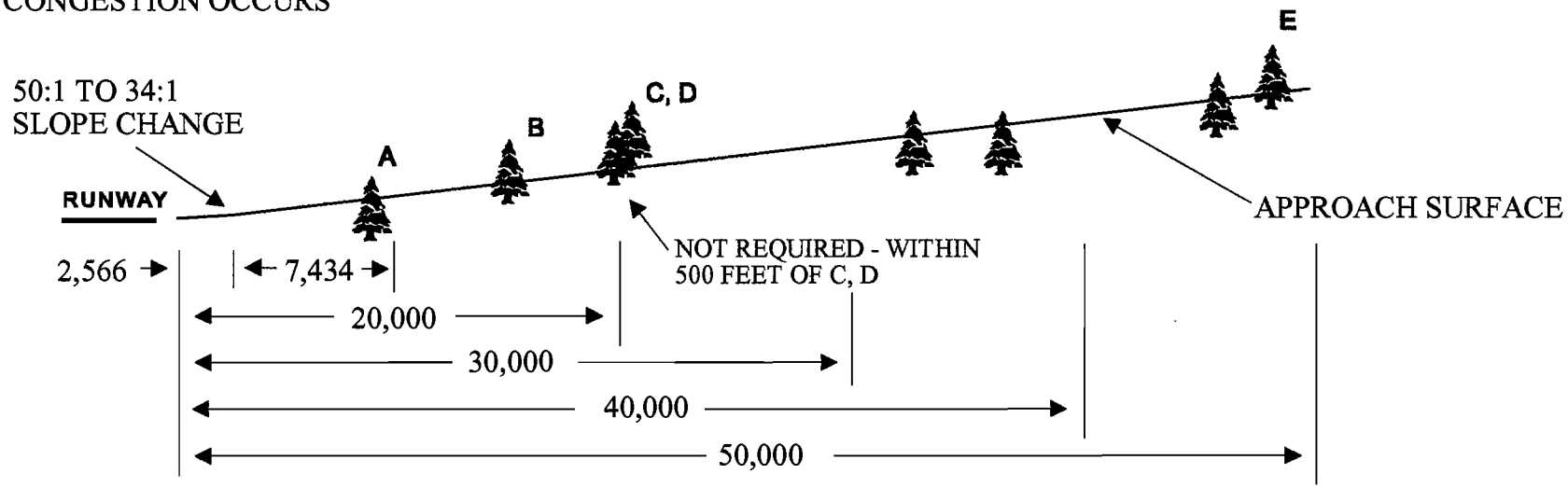
FIGURE 3.6

OBSTRUCTION REPRESENTATION IN FIRST 2,566 FEET OF A PRECISION APPROACH AREA

OBSTRUCTION REPRESENTATION IN A PRECISION APPRAOCH AREA SHALL INCLUDE THE:

A- HIGHEST OBSTRUCTION BETWEEN 2,566 FEET AND 10,000 FEET
B- HIGHEST OBSTRUCTION IN THE FIRST 20,000 FEET
C- HIGHEST OBSTRUCTION IN THE FIRST 30,000 FEET
D- HIGHEST OBSTRUCTION IN THE FIRST 40,000 FEET
E- HIGHEST OBSTRUCTION IN THE APPROACH AREA

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS



DIMENSIONS ARE IN FEET

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

NOT TO SCALE

FIGURE 3.7

OBSTRUCTION REPRESENTATION IN THE PRECISION APPROACH AREA

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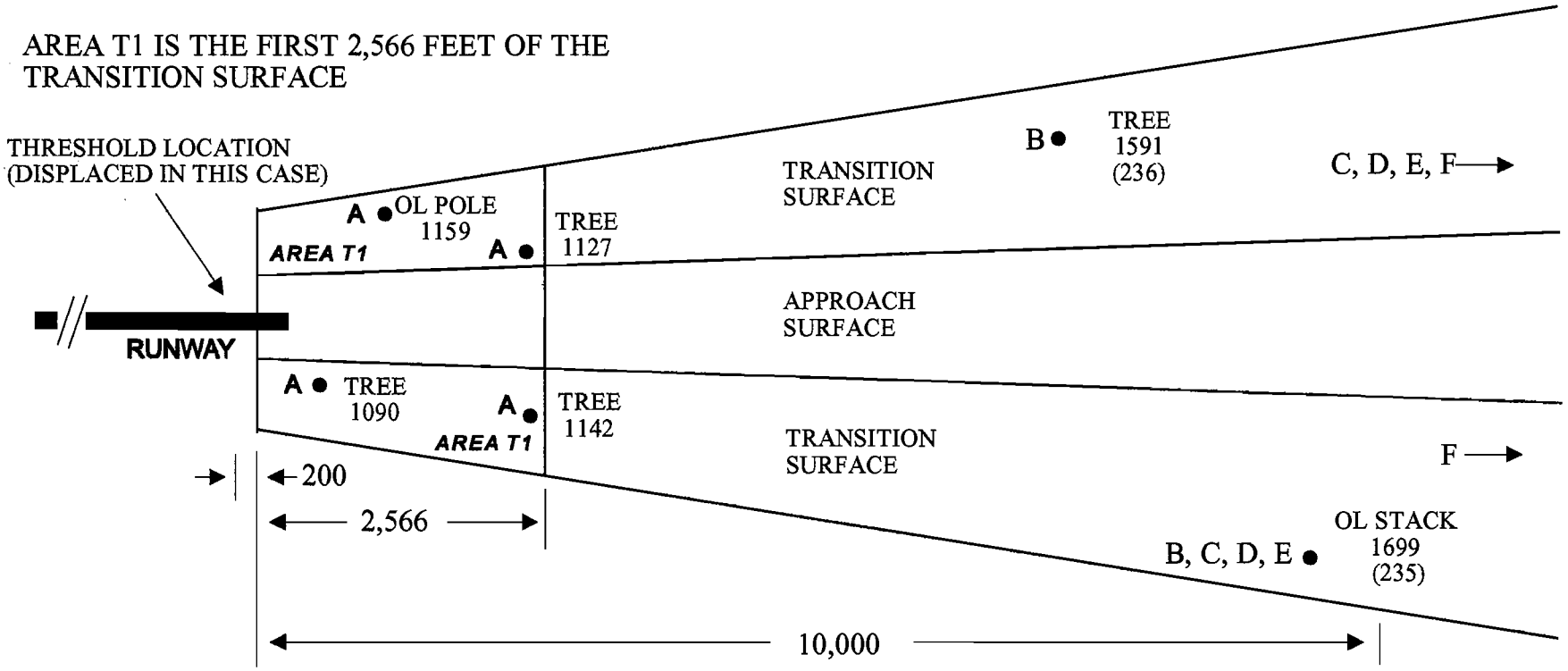
OBSTRUCTION REPRESENTATION IN EACH TRANSITION AREA SHALL INCLUDE THE:

A- TWO HIGHEST OBSTRUCTIONS IN AREA T1
B- HIGHEST OBSTRUCTION IN THE FIRST 10,000 FEET
C- HIGHEST OBSTRUCTION IN THE FIRST 20,000 FEET
D- HIGHEST OBSTRUCTION IN THE FIRST 30,000 FEET
E- HIGHEST OBSTRUCTION IN THE FIRST 40,000 FEET
F- HIGHEST OBSTRUCTION IN EACH TRANSITION AREA

AREA T1 IS THE FIRST 2,566 FEET OF THE TRANSITION SURFACE

SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS



THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 3.8

OBSTRUCTION REPRESENTATION IN THE TRANSITION AREAS

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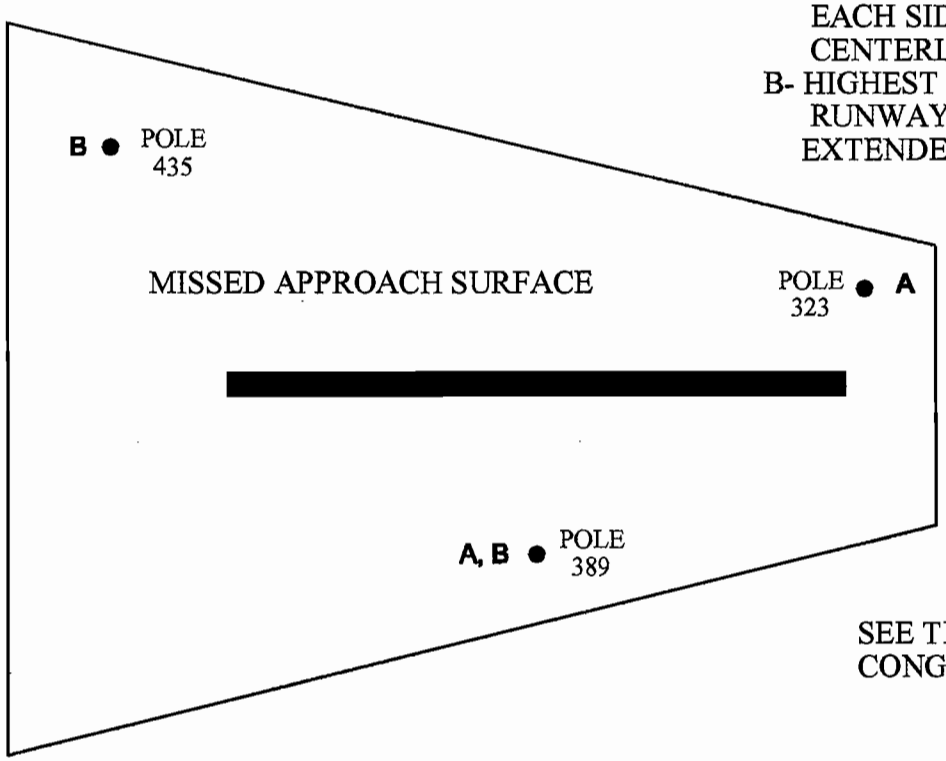
OBSTRUCTION REPRESENTATION IN THE MISSED APPROACH AREA SHALL INCLUDE THE:

A- MOST PENETRATING OBSTRUCTION ON EACH SIDE OF THE RUNWAY CENTERLINE OR CENTERLINE EXTENDED.

B- HIGHEST OBSTRUCTION ON EACH SIDE OF THE RUNWAY CENTERLINE OR CENTERLINE EXTENDED.



SEE TEXT WHEN OBJECT/OBSTRUCTION CONGESTION OCCURS

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

NOT TO SCALE

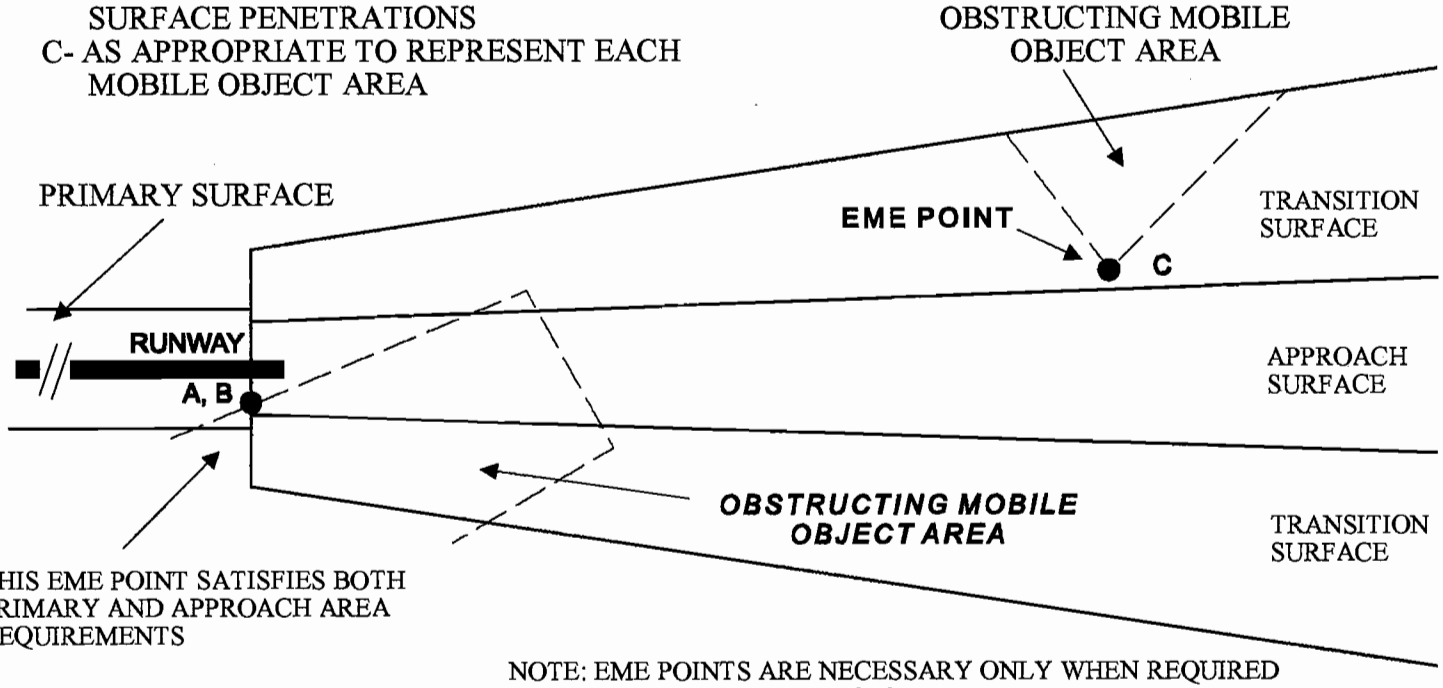
FIGURE 3.9

OBSTRUCTION REPRESENTATION IN THE MISSED APPROACH AREA

EME POINTS SHALL BE SELECTED AT THE:

A- POINT NEAREST TO THE RUNWAY CENTERLINE AT THE TRESHOLD FOR PRIMARY SURFACE PENETRATIONS
B- MOST PENETRATING POINT FOR APPROACH SURFACE PENETRATIONS
C- AS APPROPRIATE TO REPRESENT EACH MOBILE OBJECT AREA

SEE TEXT WHEN OBJECT / OBSTRUCTION CONGESTION OCCURS



NOTE: EME POINTS ARE NECESSARY ONLY WHEN REQUIRED AS REPRESENTATIVE OBJECTS.

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS -SEE TEXT FOR COMPLETE STANDARDS

NOT TO SCALE

FIGURE 3.10

DIMENSIONS ARE IN FEET

OBSTRUCTING MOBILE OBJECT AREAS AND ESTIMATED MAXIMUM ELEVATION (EME) POINTS

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SECTION 4

AREA NAVIGATION APPROACH (VERTICAL LANDING) SURVEYS

SECTION 4
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AREA NAVIGATION APPROACH (VERTICAL LANDING) SURVEYS

SUBSECTION **PAGE**

SECTION 4: AREA NAVIGATION APPROACH (VERTICAL LANDING) SURVEYS

1. DESCRIPTION

Area Navigation Approach (ANA) (Vertical Landing) surveys provide data for the Heliport Reference Point (HRP) and associated obstructions to support precision and nonprecision instrument approach procedures development for vertical landing aircraft using area navigation systems, such as, GPS.

2. DATUM TIE AND LOCAL CONTROL

To Be Developed

3. ACCURACIES

To Be Developed

4. HELIPORT REFERENCE POINT

To Be Developed

5. NAVIGATIONAL AIDS

To Be Developed

6. OBSTRUCTIONS

6.1. DEFINITION

To Be Developed

6.2. OBSTRUCTION IDENTIFICATION SURFACE

See Table 4.1 and Figure 4.1

TABLE 4.1

OBSTRUCTION IDENTIFICATION SURFACE

BEGINS	TO BE DEVELOPED
LENGTH	TO BE DEVELOPED
WIDTH AT BEGINNING	TO BE DEVELOPED
WIDTH AT END	TO BE DEVELOPED
SURFACE SLOPE	TO BE DEVELOPED

6.3. SPECIAL CASES

To Be Developed

6.4. SELECTION

To Be Developed

7. PLANIMETRIC DETAIL

To Be Developed

8. METEOROLOGICAL APPARATUS

To Be Developed

9. MISCELLANEOUS

To Be Developed

10. DATA DELIVERY

To Be Developed

TO BE DEVELOPED

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT FOR COMPLETE STANDARDS

DIMENSIONS ARE IN FEET

NOT TO SCALE

FIGURE 4.1

9/1/96

OBSTRUCTION IDENTIFICATION SURFACES

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SECTION 5

SPECIAL PURPOSE SURVEYS

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SPECIAL PURPOSE SURVEYS

SUBSECTION **PAGE**

SECTION 5: SPECIAL PURPOSE SURVEYS

1. DESCRIPTION

Special Purpose (SP) surveys provide selected data on an "as requested" basis. They typically furnish navigational aid (NAVAID) and runway information to support instrument approach procedure development. These surveys, which may be conducted entirely off airport property, are usually limited in extent with the particular survey requirements specified for each project.

2. DATUM TIE AND LOCAL CONTROL

Datum tie and local control requirements for all surveys accomplished in accordance with FAA No. 405 standards are identified in Appendix 3.

3. ACCURACIES

Accuracy requirements for all data provided in accordance with FAA No. 405 standards are identified in Appendix 5.

4. RUNWAY AND STOPWAY POINTS

Runway/stopway data requirements will be identified in individual project instructions.

5. NAVIGATIONAL AIDS

Navigational aid requirements will be identified in individual project instructions.

6. OBSTRUCTIONS

Obstruction requirements will be identified in individual project instructions.

7. PLANIMETRIC DETAIL

Planimetric detail requirements will be identified in individual project instructions.

8. METEOROLOGICAL APPARATUS

Meteorological apparatus requirements will be identified in individual project instructions.

9. MISCELLANEOUS

Miscellaneous data requirements will be identified in individual project instructions.

10. DATA DELIVERY

SP survey data will be delivered in formats appropriate to the individual survey data and user requirements.

SECTION 6

AIRPORT LAYOUT SURVEYS

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AIRPORT LAYOUT SURVEYS

SUBSECTION **PAGE**

SECTION 6: AIRPORT LAYOUT SURVEYS

1. DESCRIPTION

Airport Layout (AL) surveys provide detailed runway, taxiway, and apron information in a digital format for use in safely guiding taxiing aircraft, especially in poor visibility conditions. These data can be converted to an Airport Surface Detection Equipment (ASDE) radar overlay allowing air traffic controllers to monitor and direct ground traffic, or to a moving map display in a GPS equipped aircraft cockpit to provide the crew with taxi guidance.

AL surveys also establish (if it does not exist) geodetic control in the airport vicinity consisting of permanent survey marks accurately connected to the National Spatial Reference System (NSRS). This control and the NSRS connection assures accurate relativity between surveyed points on the airport and between these points and other surveyed points in the National Airspace System (NAS), including the navigation satellites. In addition, this control supports not only AL surveys, but also future engineering activities, such as, runway/taxiway construction, NAVAID siting, obstruction clearing, road building, and other airport improvement projects.

2. DATUM TIE AND LOCAL CONTROL

Datum tie and local control requirements for all surveys accomplished in accordance with FAA No. 405 standards are identified in Appendix 3.

3. ACCURACIES

Accuracy requirements for all data provided in accordance with FAA No. 405 standards are identified in Appendix 5.

4. RUNWAY POINTS

To Be Developed

5. NAVIGATIONAL AIDS

To Be Developed

6. OBSTRUCTIONS

To Be Developed

7. PLANIMETRIC DETAIL

To Be Developed

8. METEOROLOGICAL APPARATUS

To Be Developed

9. MISCELLANEOUS

To Be Developed

10. DATA DELIVERY

To Be Developed

SECTION 7

WIDE AREA AUGMENTATION SYSTEM SURVEYS

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WIDE AREA AUGMENTATION SYSTEM SURVEYS

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SECTION 7: WIDE AREA AUGMENTATION SYSTEM SURVEYS

1. DESCRIPTION

Wide Area Augmentation System (WAAS) surveys establish two permanent survey marks (PSM) at FAA WAAS sites and determine accurate positions and elevations for these marks. These PSM's provide initial geodetic control for WAAS implementation and later serve as permanent geodetic references.

The WAAS is a network of continuously operated, accurately located, GPS receivers and the associated data links which supply critical GPS data to aircraft, thereby enhancing navigation accuracy and integrity.

2. DATUM TIE AND LOCAL CONTROL

Datum tie and local control requirements for all surveys accomplished in accordance with FAA No. 405 standards are identified in Appendix 3.

3. ACCURACIES

Accuracy requirements for all data provided in accordance with FAA No. 405 specifications are identified in Appendix 5.

4. RUNWAY POINTS

Runway data is not required.

5. NAVIGATIONAL AIDS

Navigational aid data is not required.

6. OBSTRUCTIONS

Obstruction data is not required.

7. PLANIMETRIC DETAIL

Planimetric detail is not required.

8. METEOROLOGICAL APPARATUS

Meteorological apparatus is not required.

9. MISCELLANEOUS

None

10. DATA DELIVERY

WAAS data will be delivered in formal, hard copy reports.

SECTION 8

AERIAL PHOTOGRAPHY

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AERIAL PHOTOGRAPHY

SUBSECTION **PAGE**

SECTION 8: AERIAL PHOTOGRAPHY

1. DESCRIPTION

Aerial photographs are acquired to support several aeronautical surveys, including the Airport Obstruction Chart (AOC), Area Navigation Approach, and Airport Layout surveys. Contact scale, film type, and other parameters may vary depending on the specific application. When changes from these standards are necessary, the change will be specified in individual project instructions.

2. EQUIPMENT AND MATERIALS

2.1. CAMERA

The aerial camera shall meet the following specifications:

- Single lens metric camera with quality equivalent to or better than a Wild RC8 or Zeiss RMK-A 15/23

- 9 inch x 9 inch format

- Between-the-lens, variable speed shutter

- Six inch (153 ±3 mm) focal length lens having a usable angular field not less than 90 degrees.

- Minimum resolution of 15 lines/mm with an Area Weighted Average Resolution (AWAR) not less than 55 lines/mm. Tangential distortion shall not exceed 0.010 mm and radial distortion shall not exceed 0.030 mm.

- Equipped with a vacuum or pressure devise for holding film flat against a platen at the instant of exposure. Platen departure from a true plane shall not exceed 0.0005 inch.

- Record on each exposure at least 8 fiducial marks. Fiducial marks shall be located in each corner of the format and at the center of each side.

- Record on each exposure a clock displaying correct coordinated universal time.

- Record on each exposure the lens identification number and focal length.

- Recording a level bubble on each exposure is desirable but not required.

In addition to the specific camera requirements, a certificate of calibration, no older than three years, shall be maintained. Any disturbance of the camera that will affect its calibration automatically voids the calibration certificate.

2.2. FILM

Film shall be Kodak Plus X 2402, Aerographic AGFA Pan 150 PE, or equivalent. The use of "equivalent" films require prior approval by appropriate FAA officials. Film shall be shipped and handled in accordance with the manufacturers recommendations.

3. FLYING HEIGHT

Flying height shall vary depending on the application. Flying height variation shall not exceed 2 percent of the target height.

4. WEATHER, SOLAR ALTITUDE, AND TIME OF YEAR

No clouds or cloud shadows shall appear on the photographs. Overcast shall be permitted above the

flying altitude if it does not cause ground mottling or a discernable reduction in ground object shadows. Sun angle shall not be less than 30 degrees above the horizon.

Photography shall be obtained at a time of year when trees are in full foliage.

5. NAVIGATION

Flight line deviation from its target ground track shall not exceed X, where X = flying height in feet/20.

Flight lines may be patched. The patched portion shall be flown in the same nominal direction and under similar physical conditions as the original line.

6. TILT

Tilt shall not exceed four (4) degrees for any photographic frame and shall average not more than two (2) degrees for any ten (10) consecutive frames. The average tilt for the entire project shall not exceed one (1) degree. Relative tilt exceeding six (6) degrees between any two successive frames may be cause for rejecting that portion of the flight line.

7. CRAB

Crab angle as measured from the average line of flight shall not exceed five (5) degrees. The course heading differential between any two successive exposures shall not exceed five (5) degrees.

8. OVERLAP AND SIDELAP

Forward overlap shall be 60 percent $\pm$ 5 percent between consecutive exposures. The average sidelap (overlap of parallel strips of vertical photographs) shall be 30 percent $\pm$ 10 percent. Any frame having sidelap less than 20 percent or more than 40 percent may be rejected.

9. PHOTOGRAPH LABELING

Each usable frame shall be titled within the image area between 1/16 inch and 1/4 inch from the format border using machine lettering approximately 1/5 inch high. Each title shall consist of the agency's initials ("NOS" for National Ocean Service), date of photography, camera identifier ("X" shall be used to indicate a contractor's camera), film type ("P" for panchromatic), lens serial number, and exposure number.

Example: NOS 06-23-90 XP UAG332 No 1501

The title may be along any edge of the frame but the preferred location is along the leading edge. The location shall be consistent for all photographs under this contract.

For each lens system used, usable exposures shall be numbered in an unbroken sequence starting at 0001 for the first exposure and continuing through the last exposure by that lens system. The numbering sequence shall not be broken even though more than one airport is photographed, more than one roll of film is used, or the film is spliced.

If splicing is performed, tape residue, finger prints, and other blemishes from the splicing shall be avoided.

Blanks and other unusable exposures shall not be included in the exposure numbering sequence and shall not be labeled.

Film exposed by different lens systems shall not be spliced onto the same roll.

10. FILM PROCESSING

Original film negative shall be processed to a gamma of 0.95 $\pm$ 0.05 for Kodak Plus X 2402 and 1.25 $\pm$ 0.05 for AGFA Pan 150 PE. Base fog density for both films shall not exceed 0.10 with a minimum density above base fog of 0.30 and a maximum density above base fog of 1.35. Processing of "equivalent" films shall be in accordance with the Chief, Photogrammetry Branch, National Geodetic Survey.

A standard reference sensitometric step wedge shall be exposed near the beginning of each film roll.

11. IMAGE QUALITY

Image quality on the original negative film and on all copies shall meet the highest professional standards. Dark areas shall not bleed together and individual objects shall be readily discernable. Detail shall be sufficiently sharp to allow photogrammetric measurement of tree heights, compilation of runway/taxiway edges and other fine map features, and accomplishment of other intended uses for the film. Photographic products shall also be free of blemishes, scratches, tears, and irregularities.

APPENDIX 1

UNIVERSAL DATA DELIVERY FORMAT (UDDF)

APPENDIX 1: UNIVERSAL DATA DELIVERY FORMAT (UDDF)

The Universal Data delivery Format (UDDF) is a digital delivery system which provides airport, runway, navigational aid, obstruction, and additional information in a standard ASCII format. This information can be easily down loaded into user data files and data bases.

UDDF files are organized into the following five sections::

-Airport Data

Furnishes airport location identifier and site number, FAA region, airport name and associated city and state, survey datums, magnetic declination, and other airport related information.

-Runway Data

Furnishes runway, stopway, and blast pad information.

-Navigational Aid Data

Furnishes navigational aid information, including computed distances between NAVAIDS and selected runway points.

-Obstruction data

Furnishes obstruction information, including computed distances from, and heights above selected runway points.

-Additional Information

Furnishes miscellaneous information that cannot be logically included with the other data, such as, "nice to know" and special information that concerns the airport or an individual UDDF file.

UDDF information, including a complete documentation and access instructions, can be obtained by calling the National Geodetic Survey Information Branch at 301-713-3242 or by accessing the following Internet address:

http://www.ngs.noaa.gov/AERO/aero.html

APPENDIX 2

AIRPORT REFERENCE POINT COMPUTATION

APPENDIX 2: AIRPORT REFERENCE POINT COMPUTATION

The Airport Reference Point (ARP) is the approximate geometric center of all usable runways. The ARP position computation is somewhat similar to a center of mass computation, except that only two dimensions are considered.

The datums used in the computations are normally selected as the lowest absolute value latitude and longitude coordinates, respectively, of all runway ends used in the computation. This convention eliminates computing with negative moments.

ARP_{LAT} = LATITUDE DATUM + (SUM OF RUNWAY MOMENTS ABOUT THE LATITUDE DATUM/SUM OF RUNWAY LENGTHS)

ARP_{LON} = LONGITUDE DATUM + (SUM OF RUNWAY MOMENTS ABOUT THE LONGITUDE DATUM/SUM OF RUNWAY LENGTHS)

RUNWAY MOMENT ABOUT THE LATITUDE DATUM = RUNWAY GROUND LENGTH TIMES THE DISTANCE IN SECONDS BETWEEN THE APPROXIMATE RUNWAY CENTER POINT* AND THE LATITUDE DATUM

RUNWAY MOMENT ABOUT THE LONGITUDE DATUM = RUNWAY GROUND LENGTH TIMES THE DISTANCE IN SECONDS BETWEEN THE APPROXIMATE RUNWAY CENTER POINT* AND THE LONGITUDE DATUM

RUNWAY COORDINATES MUST BE ENTERED AS ABSOLUTE VALUES.

RUNWAY LENGTHS MUST BE ENTERED AS GROUND LENGTH, ROUNDED TO THE NEAREST WHOLE FOOT.

* THE APPROXIMATE RUNWAY CENTER POINT IS THE MEAN OF THE LATITUDES AND LONGITUDES OF A RUNWAY'S ENDS. THIS CONVENTION ELIMINATES THE NEED FOR COMPLEX GEODETIC FORMULAS TO COMPUTE THE PRECISE RUNWAY CENTER POINT, THUS ALLOWING SIMPLE AND CONSISTENT ARP COMPUTATIONS AFTER ONLY BRIEF INSTRUCTIONS.

A SAMPLE ARP COMPUTATION FOLLOWS (SEE FIGURE A2.1):

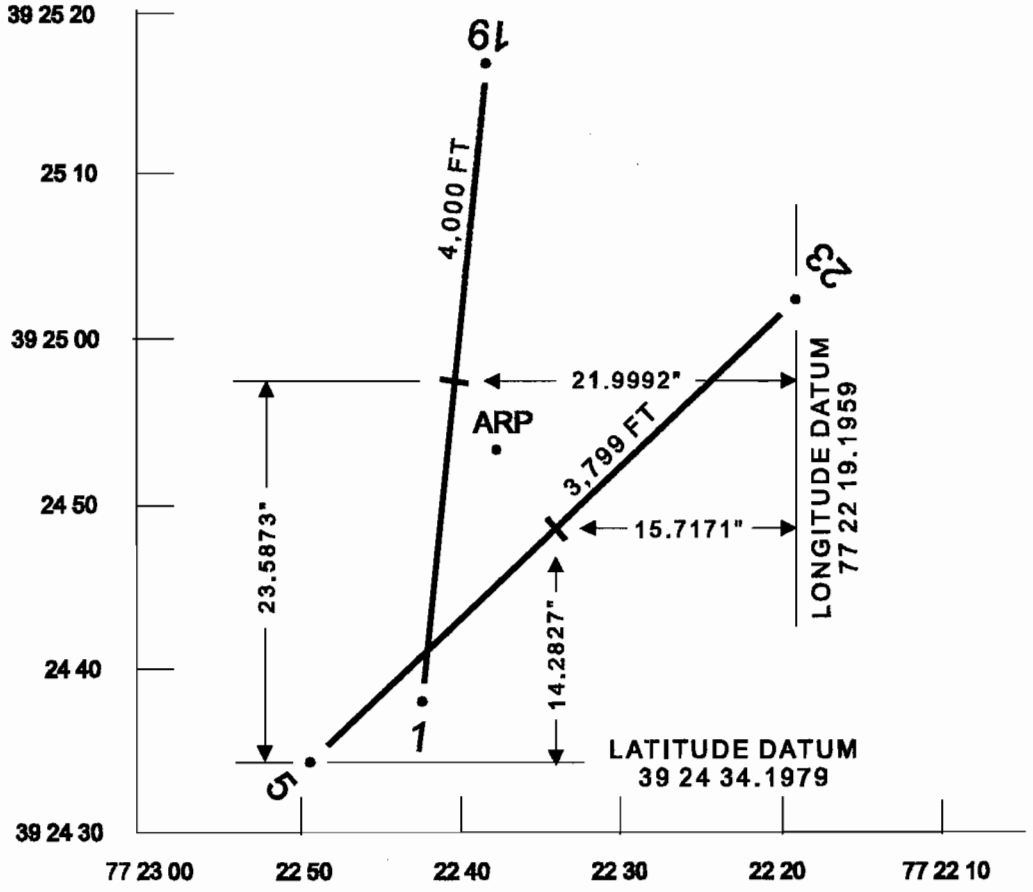
APPROXIMATE RUNWAY CENTER PTS:

RWY 1/19 LAT = 39 24 57.7852
LON = 77 22 41.1951
RWY 5/23 LAT = 39 24 48.4806
LON = 77 22 34.9130

ARP_{LAT} = 39 24 34.1979 + (4,000 FT(23.5873 SEC) + 3,799 FT(14.2827 SEC))/7,799 FT
= 39 24 34.1979 + 19.0549 SEC
= 39 24 53.3

ARP_{LON} = 77 22 19.1959 + (4,000 FT(21.9992 SEC) + 3,799 FT(15.7171 SEC))/7,799 FT
= 77 22 19.1959 + 18.9391 SEC
= 77 22 38.1

RUNWAY END	LATITUDE	LONGITUDE	GROUND* LENGTH
1	39 24 38.0871	077 22 43.3322	4,000 FT
19	39 25 17.4832	077 22 39.0579	
5	39 24 34.1979	077 22 50.6301	3,799 FT
23	39 25 02.7632	077 22 19.1959	



* USE GROUND, NOT GEODETIC, RUNWAY LENGTH ROUNDED TO THE NEAREST WHOLE FOOT

THIS FIGURE EXPLAINS OR CLARIFIES CERTAIN DATA REQUIREMENTS - SEE TEXT FOR COMPLETE STANDARDS

NOT TO SCALE

FIGURE A2.1

AIRPORT REFERENCE POINT COMPUTATION

4/15/98 CHANGE 1

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APPENDIX 3

DATUM TIE AND LOCAL CONTROL

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DATUM TIE AND LOCAL CONTROL

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APPENDIX 3: DATUM TIE AND LOCAL CONTROL

1. GENERAL

1.1. TERMINOLOGY

As used in this appendix, the term "observation" means the survey observations that result in a position and/or elevation for the survey mark in question, whether the mark is an existing mark or a newly set mark. The term "set" means physically constructed. A mark may be set at one time and be observed for position and/or elevation at a later time.

1.2. DATUMS

Surveys accomplished in accordance with FAA No. 405 standards shall be tied to the National Spatial Reference System (NSRS). Positions and ellipsoid heights shall be referenced to the North American Datum of 1983 (NAD 83) which is operationally equivalent to, and may be used as, World Geodetic System of 1984 (WGS 84) values for charting and navigation purposes. Orthometric heights (MSL elevations) shall be referenced to the North American Vertical Datum of 1988 (NAVD 88).

1.3. MARK STAMPING

Reference stations set at Wide Area Augmentation System sites, Heliport Reference Points set at Area Navigation Approach - Vertical Landing sites, and Primary Airport Control Stations and Secondary Airport Control Stations set at airports shall have unique stampings.

Marks set at a site without an FAA site identifier shall be stamped with a name that characterizes the mark location plus the year the mark was set, such as, "KNOLL 1994".

Marks set at a site with an official FAA site identifier shall be stamped with that identifier, followed by a sequential letter, followed by the year the mark was set. The sequential letter shall be assigned in the chronological order that the mark was set. For example, the first mark set at the Boston Air Route Traffic Control Center at Nashua, New Hampshire, during the 1994 survey would be stamped "ZBW A 1994". The second mark set in 1994 would be "ZBW B 1994".

If marks using this stamping convention already exist, the sequential letter for the next mark should use the next letter after the existing letters. For example, if "K78 B 1995" already exist, the next mark set in 1995 would be stamped "K78 C 1995". If this next mark was set in 1996, it would be stamped "K78 C 1996".
If a previously set mark used a letter in another stamping convention, such as, "AP STA A 1984", the next mark would be stamped disregarding the existing "A". A stamping of "K78 A 1995" for the next mark set at this airport would be appropriate.

Stampings of destroyed or presumed destroyed marks shall not be reused.

Previous stampings will never be changed or added to, even if the FAA site identifier changes.

All letters shall be capitals.

1.4. ACCURACIES

Accuracy requirements for all data provided in accordance with FAA No. 405 standards are listed in Appendix 5.

2. AIRPORT SURVEYS

2.1. GENERAL

Surveys included under this section are surveys accomplished on, or in the vicinity of, an airport and specifically intended to support aircraft operations at that airport. These surveys include: Airport Obstruction Chart (AOC); Area Navigation Approach (ANA) - Conventional Landing; and Airport Layout (AL). Requirements for Special Purpose surveys are identified in Section 5 of this appendix.

Three permanent survey marks (PSM) shall be established on, or within one km of, the airport. One of these marks shall be designated the Primary Airport Control Station (PACS). Horizontal and vertical datum ties shall be made directly between the PACS and the NSRS. The other two marks shall be designated Secondary Airport Control Stations (SACS). Horizontal and vertical connections shall be made directly between the SACS and the PACS.

Existing stations may be used as the PACS and SACS if they meet the accuracy, siting, construction, and other criteria identified in this appendix and Appendix 5.

2.2. CONTROL STATION SITING

PACS shall be established in a secure area on airport property. A GPS suitable site should be selected where surveying equipment may be left unattended at the mark with a minimum probability of disturbance.

SACS should be established on airport property if practical. However, if the siting requirements, such as, intervisibility and spacing as described below, cannot be met, one SACS may be set off the airport but no further than 1 km from the nearest airport boundary.

If establishing the PACS and SACS requires new monumentation, the new monuments should be set no closer than 60 meters from a runway edge, if practical. If an existing control station is used, this station should be at least 15 meters from a runway edge. In all cases, PACS and/or SACS should be at least 400 meters apart.

PACS and SACS should be located so that a surveying tripod can be situated over the mark. In addition, if the mark could be in peril from snow removal, mowing, and other operations, it should be slightly recessed.

PACS and SACS should be strategically located so as to provide maximum use for subsequent surveys yet situated where the chances of future disturbance will be minimal. An elevated site with runway end visibility is desirable. PACS and SACS should also be located where future station occupation will cause no interference to or from aircraft, including from prop and jet blast. The sight path between stations over paved areas should be minimized.

Intervisibility choices for PACS and SACS are:

FIRST CHOICE

The PACS and both SACS are all intervisible with each other.

SECOND CHOICE

The PACS is intervisible with both SACS but the SACS are not intervisible with each other.

THIRD CHOICE

The PACS is intervisible with one SACS and both SACS are intervisible with each other.

2.3. CONTROL STATION CONSTRUCTION

PACS and SACS construction shall meet mark stability standards as defined by the National Geodetic Survey, National Oceanic and Atmospheric Administration, for Federal Base Network stations.

- PACS

Stability "A" or "B." In addition, stability "C" is acceptable if, and only if, the monument: (1) already exists, (2) is poured in place concrete, (3) is a triangulation station, reference mark, azimuth mark, or bench mark stamped "U.S. Coast and Geodetic Survey", or any mark stamped "National Geodetic Survey", (4) is set below the frost line, (5) is set in nonexpansive soils, and (6) shows no evidence of movement.

- SACS

Stability "A," "B," or "C."

3. HELIPORT SURVEYS

3.1. GENERAL

Surveys included under this section are all surveys accomplished on, or in the vicinity of, heliports and specifically intended to support aircraft operations at that heliport. These surveys include the Area Navigation Approach (ANA) - Vertical Landing surveys.

3.2. CONTROL STATION SITING

To Be Developed

3.3. CONTROL STATION CONSTRUCTION

To Be Developed

4. WIDE AREA AUGMENTATION SYSTEM SURVEYS

4.1. GENERAL

Surveys included under this section are all surveys specifically intended to support the Wide Area Augmentation System. Two PSM's shall be established at each WAAS site. These marks are called WAAS reference stations. Horizontal and vertical datums ties shall be made directly between NSRS and one of the reference stations. To ensure the required relative accuracy between the two reference stations, direct horizontal and vertical ties shall be made between the two stations.

Existing marks may be used as the WAAS reference stations if they meet the accuracy, siting, construction, and other criteria identified in this appendix and Appendix 5.

4.2. CONTROL STATION SITING

While there are no separation or intervisibility requirements for WAAS reference stations, other siting guidelines apply. If practical, one station should be established in a secure area and the other established in a public access area. Neither station should be further than 1 km from the WAAS antenna site. They should be established where the chances of future disturbance will be minimal and be sufficiently separated to reduce the probability that both marks would be destroyed by the same construction project.

In addition, both stations should be located where they have maximum practical sky visibility above 15 degrees above the horizon.

4.3. CONTROL STATION CONSTRUCTION

WAAS reference station construction shall meet mark stability "A" or "B" standards as defined by the National Geodetic Survey, National Oceanic and Atmospheric Administration, for Federal Base Network stations.

5. SPECIAL PURPOSE SURVEYS

Special Purpose (SP) surveys provide selected data on an "as requested" basis. They typically furnish navigational aid (NAVAID) and runway information to

support instrument approach procedure development. These surveys, which may be conducted entirely off airport property, are usually limited in extent, with the particular survey requirements specified for each project. The datum ties for SP surveys shall be in accordance with Section 1.2. of this appendix. Control station requirements, including mark stamping, siting, and construction will be specified for each project.

APPENDIX 4

NAVIGATIONAL AID SURVEY POINTS

APPENDIX 4: NAVIGATIONAL AID SURVEY POINTS

NAVAID	HORZ SURVEY POINT (HSP)	VERT SURVEY POINT (VSP)
AIR ROUTE SURVEILLANCE RADAR (ARSR)	(1)	(2)
AIRPORT SURVEILLANCE RADAR (ASR)	(1)	(2)
DISTANCE MEASURING EQUIPMENT (DME) (3)	CENTER OF ANTENNA COVER	CENTER OF ANTENNA COVER
LOCALIZER (LOC) (4)	CENTER OF ANTENNA SUPPORTING STRUCTURE	(2)
GLIDE SLOPE - ALL EXCEPT END FIRE TYPE (GS)	CENTER OF ANTENNA SUPPORTING STRUCTURE	(2)
GLIDE SLOPE - END FIRE TYPE (GS)	PHASE CENTER REFERENCE POINT	PHASE CENTER REFERENCE PT.
INNER MARKER (IM)	CENTER OF ANTENNA ARRAY	N/A
MIDDLE MARKER (MM)	CENTER OF ANTENNA ARRAY	N/A
OUTER MARKER (OM)	CENTER OF ANTENNA ARRAY	N/A
BACK COURSE MARKER (BCM)	CENTER OF ANTENNA ARRAY	N/A
FAN MARKER (FM)	CENTER OF ANTENNA ARRAY	N/A
LOCALIZER TYPE DIRECTIONAL AID (LDA)	CENTER OF ANTENNA SUPPORTING STRUCTURE	(2)
MLS AZIMUTH GUIDANCE (MLSAZ)	PHASE CENTER REFERENCE POINT	PHASE CENTER REFERENCE PT.

NAVIGATIONAL AID SURVEY POINTS CONT.

NAVAID	HORZ SURVEY POINT (HSP)	VERT SURVEY POINT (VSP)
MLS ELEVATION GUIDANCE (MLSEL)	PHASE CENTER REFERENCE POINT	PHASE CENTER REFERENCE PT.
NONDIRECTIONAL BEACON (NDB)	CENTER OF ANTENNA ARRAY	N/A
SIMPLIFIED DIRECTIONAL FACILITY (SFD)	CENTER OF ANTENNA SUPPORTING STRUCTURE	(2)
TACTICAL AIR NAVIGATION (TACAN)	CENTER OF ANTENNA COVER	(2)
VHF OMNI DIRECTIONAL RANGE (VOR)	CENTER OF ANTENNA COVER	(2)
VOR/ TACAN (VORTAC)	CENTER OF ANTENNA COVER	(2)

EXPLANATION OF CODE NUMBERS IN PARENTHESIS

(1) The HSP will be the axis of antenna rotation if possible. If the antenna is covered, the HSP will be the center of the antenna cover.

(2) The VSP for these items will be the intersection of the ground, gravel, concrete pad, or other base and a plumb line through the HSP. When access to this point is impractical, elevation of the VSP will be approximated.

(3) DME elevations are required only when the DME is frequency paired with an Instrument Landing System or Microwave Landing System.

(4) When LOC clearance and course array antennas are both present, only the course array antenna will be surveyed.

NOTE: A compass locator within 50 feet of an Instrument Landing System marker is considered collocated at the position of the marker. Other NAVAIDS are not considered collocated unless their HSP's are the same.

APPENDIX 5

ACCURACIES

APPENDIX 5
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ACCURACIES

SUBSECTION **PAGE**

APPENDIX 5: ACCURACIES

1. GENERAL

Accuracy standards for data provided under FAA No. 405 are presented in this appendix. Requirements for digital and graphic data are listed separately.

When an object is selected for its obstruction value only (for example, meteorological apparatus), obstruction accuracies apply.

All accuracies are listed in feet except control station accuracies which are listed in centimeters and graphic accuracies which are listed in millimeters on the graphic.

All accuracies are stated for a 95 percent confidence level.

The following contractions are used throughout FAA No. 405 and are repeated here for convenience:

AGL - Above Ground Level
ELLIP - Ellipsoid
HORZ - Horizontal
HRP - Heliport Reference Point
ORTHO - Orthometric
PACS - Primary Airport Control Station
SACS - Secondary Airport Control Station

2. DIGITAL ACCURACIES

Digital data is construed as any data furnished as digits, regardless of the delivery medium. FAA No. 405 digital accuracy standards are presented in the tables that follow.

2.1. CONTROL STATIONS

ITEM (VALUES ARE IN CENTIMETERS)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	AGL
PRIMARY AIRPORT CONTROL STATION (PACS) [1]	5	25	15	N/A
SECONDARY AIRPORT CONTROL STATION (SACS) [2]	3	5	4	N/A
WIDE AREA AUGMENTATION SYSTEM (WAAS) REFERENCE STATION [1]	5	10	10	N/A
WIDE AREA AUGMENTATION SYSTEM (WAAS) REFERENCE STATION [3]	1	0.2	2	N/A

[1] ACCURACIES ARE RELATIVE TO THE NEAREST NATIONAL GEODETIC SURVEY SANCTIONED CONTINUOUSLY OPERATING REFERENCE STATION

[2] ACCURACIES ARE RELATIVE TO THE PACS AND OTHER SACS AT THE AIRPORT

[3] ACCURACIES ARE RELATIVE TO THE OTHER WAAS REFERENCE STATION AT THE SITE

2.2. HELIPORT REFERENCE POINT

ITEM (VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	AGL
HELIPORT REFERENCE POINT ACCURACY STANDARDS ARE TO BE DEVELOPED				

2.3. METEOROLOGICAL APPARATUS

ITEM	(VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL

THE HORIZONTAL ACCURACY IS 20 FEET WHEN LOCATED ON A PUBLIC USE AIRPORT OR MILITARY FIELD AND 50 FEET FOR ALL OTHER LOCATIONS. ELEVATIONS ARE NOT REQUIRED.

ACCURACIES ARE RELATIVE TO THE NEAREST PACS, SACS, OR HRP

2.4. MISCELLANEOUS

ITEM	(VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
AIRPORT REFERENCE POINT		1.00	N/A	N/A	N/A
FLOOR OF CONTROL TOWER CAB		N/A	1.00	1.00	N/A

ACCURACIES ARE RELATIVE TO THE NEAREST PACS, SACS, OR HRP

2.5. NAVIGATIONAL AIDS

ITEM (VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
ELECTRONIC NAVAIDS				
AIR ROUTE SURVEILLANCE RADAR (ARSR)	(1)	100.00	100.00	N/A
AIRPORT SURVEILLANCE RADAR (ASR)	(1)	10.00	10.00	N/A
DISTANCE MEASURING EQUIPMENT (DME):				
FREQUENCY PAIRED WITH LOC	1.00	1.00	1.00	N/A
FREQUENCY PAIRED WITH MLSAZ	1.00	1.00	1.00	N/A
FREQUENCY PAIRED WITH NDB	(1)	N/A	N/A	N/A
FREQUENCY PAIRED WITH VOR	(1)	N/A	N/A	N/A
NOT FREQUENCY PAIRED	(1)	N/A	N/A	N/A
FAN MARKER (FM)	(1)	N/A	N/A	N/A
LOCALIZER (LOC)	1.00	1.00	1.00	N/A
GLIDE SLOPE (GS)	1.00	0.25	0.20	N/A
INNER MARKER (IM)	20.00	N/A	N/A	N/A
MIDDLE MARKER (MM)	20.00	N/A	N/A	N/A
OUTER MARKER (OM)	50.00	N/A	N/A	N/A
BACK COURSE MARKER (BCM)	50.00	N/A	N/A	N/A
LOCALIZER TYPE DIRECTIONAL AID (LDA)	1.00	1.00	1.00	N/A
MLS AZIMUTH GUIDANCE (MLSAZ)	1.00	1.00	1.00	N/A
MLS ELEVATION GUIDANCE (MLSEL)	1.00	0.25	0.20	N/A

2.5. NAVIGATIONAL AIDS CONT.

ITEM (VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
NONDIRECTIONAL BEACON (NDB)	(1)	N/A	N/A	N/A
SIMPLIFIED DIRECTIONAL FACILITY (SDF)	1.00	1.00	1.00	N/A
TACTICAL AIR NAVIGATION (TACAN)	(1)	100.00	100.00	N/A
VHF OMNI DIRECTIONAL RANGE (VOR)	(1)	100.00	100.00	N/A
VOR/TACAN (VORTAC)	(1)	100.00	100.00	N/A
VISUAL NAVAIDS				
AIRPORT BEACON	(1)	N/A	N/A	N/A
VISUAL GLIDESLOPE INDICATORS	20.00	N/A	N/A	N/A
REIL	20.00	N/A	N/A	N/A
APPROACH LIGHTS	20.00	N/A	N/A	N/A

THE HORIZONTAL ACCURACY REQUIREMENT FOR ITEMS CODED "(1)" IS 20 FEET WHEN LOCATED ON A PUBLIC USE AIRPORT OR MILITARY FIELD, AND 50 FEET FOR ALL OTHER LOCATIONS.

ACCURACIES ARE RELATIVE TO THE NEAREST PACS, SACS, OR HRP.

2.6. OBSTRUCTIONS

AIRPORT OBSTRUCTION CHART SURVEYS

ITEM (VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
NON MAN-MADE OBJECTS, AND MAN-MADE OBJECTS LESS THAN 200 FT. AGL, THAT PENETRATE THE FOLLOWING OBSTRUCTION IDENTIFICATION SURFACE:				
- A PRIMARY SURFACE	20.00	3.00	3.00	N/A
- THOSE AREAS OF AN APPROACH SURFACE WITHIN 10,200 FEET OF THE RUNWAY END	20.00	3.00	3.00	N/A
- THOSE AREAS OF A PRIMARY TRANSITION SURFACE WITHIN 500 FEET OF THE PRIMARY SURFACE	20.00	3.00	3.00	N/A
- THOSE AREAS OF AN APPROACH TRANSITION SURFACE THAT ARE WITHIN 500 FEET OF THE APPROACH SURFACE AND ALSO WITHIN 2,766 FEET OF THE RUNWAY END	20.00	3.00	3.00	N/A
- THOSE AREAS OF A PRIMARY TRANSITION SURFACE FURTHER THAN 500 FEET FROM THE PRIMARY SURFACE	50.00	20.00	20.00	N/A
- THOSE AREAS OF AN APPROACH TRANSITION SURFACE FURTHER THAN 500 FEET FROM AN APPROACH SURFACE AND ALSO WITHIN 10,200 FEET OF THE RUNWAY END	50.00	20.00	20.00	N/A
- THE HORIZONTAL SURFACE	50.00	20.00	20.00	N/A
- THOSE AREAS OF AN APPROACH SURFACE FURTHER THAN 10,200 FEET FROM THE RUNWAY END	100.00	50.00	50.00	N/A
- THOSE AREAS OF AN APPROACH TRANSITION SURFACE FURTHER THAN 10,200 FEET FROM THE RUNWAY END	100.00	50.00	50.00	N/A
- THE CONICAL SURFACE	100.00	50.00	50.00	N/A

2.6. OBSTRUCTIONS CONT.

AIRPORT OBSTRUCTION CHART SURVEYS

ITEM (VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
MAN-MADE OBJECTS EQUAL TO OR GREATER THAN 200 FEET AGL THAT PENETRATE THE FOLLOWING OBSTRUCTION IDENTIFICATION SURFACES:				
- A PRIMARY SURFACE	20.00	3.00	3.00	10.00
- THOSE AREAS OF AN APPROACH OR APPROACH TRANSITION SURFACE WITHIN 10,200 FEET OF THE RUNWAY END	20.00	3.00	3.00	10.00
- THE PRIMARY TRANSITION SURFACE	20.00	3.00	3.00	10.00
- AN APPROACH OR APPROACH TRANSITION SURFACE FURTHER THAN 10,200 FEET FROM THE RUNWAY END	50.00	3.00	3.00	10.00
- THE HORIZONTAL SURFACE	50.00	3.00	3.00	10.00
- THE CONICAL SURFACE	50.00	3.00	3.00	10.00

ACCURACIES ARE RELATIVE TO THE NEAREST PACS, SACS, OR HRP.

DISTANCES RELATIVE TO THE THRESHOLD OR RUNWAY END ARE MEASURED ALONG THE RUNWAY CENTERLINE OR CENTERLINE EXTENDED TO THE ABEAM POINT.

2.6. OBSTRUCTIONS CONT.

AREA NAVIGATION APPROACH (CONVENTIONAL LANDING) SURVEYS

ITEM (VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
NON MAN-MADE OBJECTS, AND MAN-MADE OBJECTS LESS THAN 200 FEET AGL, THAT PENETRATE THE FOLLOWING OBSTRUCTION IDENTIFICATION SURFACES:				
- THE PRIMARY SURFACE	20.00	3.00	3.00	N/A
- THOSE AREAS OF THE APPROACH SURFACE WITHIN 10,200 FEET OF THE THRESHOLD	20.00	3.00	3.00	N/A
- THOSE AREAS OF AN APPROACH TRANSITION SURFACE WITHIN 2,766 FEET OF THE THRESHOLD (AREA T1)	20.00	3.00	3.00	N/A
- THOSE AREAS OF THE APPROACH TRANSITION SURFACE FURTHER THAN 2,766 FEET FROM THE THRESHOLD BUT NOT MORE THAT 10,200 FEET FROM THE THRESHOLD	50.00	20.00	20.00	N/A
- THE MISSED APPROACH SURFACE	50.00	20.00	20.00	N/A
- THOSE AREAS OF THE APPROACH SURFACE FURTHER THAN 10,200 FEET FROM THE THRESHOLD	100.00	50.00	50.00	N/A
- THOSE AREAS OF THE APPROACH TRANSITION SURFACE FURTHER THAN 10,200 FEET FROM THE THRESHOLD	100.00	50.00	50.00	N/A
MAN-MADE OBJECTS EQUAL TO OR GREATER THAN 200 FEET AGL THAT PENETRATE THE FOLLOWING OBSTRUCTION IDENTIFICATION SURFACES:				
- THE PRIMARY SURFACE, THOSE AREAS OF THE APPROACH AND TRANSITION SURFACES WITHIN 10,200 FEET OF THE THRESHOLD	20.00	3.00	3.00	10.00
- THE MISSED APPROACH SURFACE	20.00	3.00	3.00	10.00

2.6. OBSTRUCTIONS CONT.

AREA NAVIGATION APPROACH (CONVENTIONAL LANDING) SURVEYS

ITEM	(VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
- THOSE AREAS OF THE APPROACH AND TRANSITION SURFACES FURTHER THAN 10,200 FEET FROM THE THRESHOLD		50.00	3.00	3.00	10.00

ACCURACIES ARE RELATIVE TO THE NEAREST PACS, SACS, OR HRP.

DISTANCES RELATIVE TO THE THRESHOLD OR RUNWAY END ARE MEASURED ALONG THE RUNWAY CENTERLINE OR CENTERLINE EXTENDED TO THE ABEAM POINT.

AREA NAVIGATION APPROACH (VERTICAL LANDING) SURVEYS

ITEM	(VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL

AREA NAVIGATION APPROACH (VERTICAL LANDING) SURVEY ACCURACY STANDARDS ARE TO BE DEVELOPED.

2.7. RUNWAY/STOPWAY POINTS

ITEM (VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
PHYSICAL END	1.00	0.25	0.20	N/A
DISPLACED THRESHOLD	1.00	0.25	0.20	N/A
THRESHOLD ZONE ELEVATION (TDZE)	N/A	0.25	0.20	N/A
SUPPLEMENTAL PROFILE POINTS	20.00	0.25	0.20	N/A
POINT ABEAM HSP FOR:				
OFFSET LOC, LDA, OR SDF	1.00	N/A	N/A	N/A
GS, MLSEL	1.00	0.25	0.20	N/A
STOPWAY LENGTH	2.00	N/A	N/A	N/A
STOPWAY END	N/A	0.25	0.20	N/A
AIRPORT ELEVATION	20.00	0.25	0.20	N/A

ACCURACIES ARE RELATIVE TO THE NEAREST PACS, SACS, OR HRP

UNLESS OTHERWISE STATED, ALL RUNWAY/STOPWAY POINTS SHALL BE ON THE RUNWAY/STOPWAY CENTERLINE.

NOTE: RUNWAY POINT ELEVATIONS NEED NOT BE REVISED UNLESS THE ELEVATION HAS CHANGED BY AT LEAST 0.5 FEET.

2.8. SPECIAL PURPOSE SURVEYS

ITEM	(VALUES ARE IN FEET)	HORZ	VERTICAL ORTHO	VERTICAL ELLIP	VERTICAL AGL
SPECIAL PURPOSE SURVEY ACCURACY STANDARDS SHALL BE IDENTIFIED FOR THE SPECIFIC SURVEY.					

3. GRAPHIC ACCURACIES

3.1. AIRPORT OBSTRUCTION CHART

THESE ACCURACY STANDARDS APPLY TO WELL DEFINED POINTS AND WELL DEFINED PLANIMETRIC DETAIL.

ITEM (VALUES ARE IN MM ON THE MAP)	ACCURACY
POINTS AND PLANIMETRIC DETAIL IN AREAS REQUIRING A 20 FOOT DIGITAL HORIZONTAL ACCURACY FOR OBSTRUCTION	0.6
POINTS AND PLANIMETRIC DETAIL IN AREAS REQUIRING A 50 FOOT DIGITAL HORIZONTAL ACCURACY FOR OBSTRUCTIONS	1.3

3.1. MISCELLANEOUS

ITEM	(VALUES ARE IN MM ON THE MAP)	ACCURACY

GRAPHIC ACCURACIES FOR OTHER THAN THE AIRPORT OBSTRUCTION CHART HAVE NOT BEEN DEFINED.

APPENDIX 6

CONTRACTIONS

APPENDIX 6: CONTRACTIONS

The following list presents the approved contractions for data provided under FAA No. 405 standards.

WORD/ PHRASE	CONTRACTION
A	
Abandoned	ABND
Above Ground Level	AGL
Accelerate-Stop Distance Available	ASDA
Advisory Circular	AC
Agricultural	AG
Air Route Surveillance Radar	ARSR
Aircraft	ACFT
Airport	ARPT
Airport Beacon	APBN
Airport District Office	ADO
Airport Facility Directory	AFD
Airport Location Point	ALP
Airport Obstruction Chart	AOC
Airport Reference Point	ARP
Airport Surface Detection Equipment	ASDE
Airport Surveillance Radar	ASR
Airport Traffic Control Tower	ATCT
Airway Beacon	AWYBN
Anemometer	AMOM
Antenna	ANT
Approach	APCH
Approach Light	APP LT
Approach Light System	ALS
Area Navigation Approach	ANA
Arresting Gear	A-GEAR
Automated Flight Service Station	AFSS
Automated Surface Observing System	ASOS
Automatic Weather Observing/Reporting System	AWOS

WORD/ PHRASE	CONTRACTION
B	
Back Course Marker	BCM
Bridge	BRDG
Building	BLDG
C	
Centerline	C/L
Ceilometer	CLOM
Chimney	CHY
Closed	CLSD
Common Traffic Advisory Frequency	CTAF
Construction	CONST
Continuously Operating Reference Station	CORS
D	
Direction Finder	DF
Displaced Threshold	DTHLD
Distance Measuring Equipment	DME
Distance to Centerline	DCLN
Distance to Runway End	DEND
Distance to Threshold	DTHR
E	
Electrical	ELEC
Elevation	EL
Elevation	ELEV
Ellipsoid	ELLIP
Engine Out Departure	EOD
Equipment	EQUIP
Estimated Maximum Elevation	EME
F	
Fan Marker	FM
Flagpole	FLGPL
Flight Service Station	FSS

WORD/ PHRASE	CONTRACTION
G	
Glide Slope	GS
Global Positioning System	GPS
Ground	GRD
Ground Control Approach	GCA
H	
Hangar	HGR
Height Above Airport	HAA
Height Above Runway	HAR
Height Above Touchdown	HAT
Heliport Reference Point	HRP
Horizontal	HORZ
Horizontal Survey Point	HSP
I	
Inner Marker	IM
Inoperative	INOP
Instrument Flight Rules	IFR
Instrument Landing System	ILS
Instrument Meteorological Conditions	IMC
International Civil Aviation Organization	ICAO
International Earth Rotation Service Terrestrial Reference Frame	ITRF
Intersection	INTXN
J	
None	
K	
None	
L	
Lead In Lighting System	LDIN
Light	LT
Lighted	LTD

WORD/ PHRASE	CONTRACTION
L (Cont.)	
Localizer	LOC
Localizer Type Directional Aid	LDA
Locator Middle Marker	LMM
Locator Outer Marker	LOM
M	
Magnetic Variation	VAR
Mean Sea Level	MSL
Microwave	MCWV
Microwave Landing System	MLS
Microwave Landing System Azimuth Guidance	MLSAZ
Microwave Landing System Elevation Guidance	MLSEL
Middle Marker	MM
Monument	MON
N	
National Airspace System	NAS
National Flight Data Center	NFDC
National Flight Data Digest	NFDD
National Geodetic Survey	NGS
National Geodetic Vertical Datum of 1929	NGVD 29
National Oceanic and Atmospheric Administration	NOAA
National Ocean Service	NOS
National Spatial Reference System	NSRS
Nautical Mile	NM
Navigational Aid	NAVAID
Nondirectional Radio Beacon	NDB
North American Datum of 1927	NAD 27
North American Datum of 1983	NAD 83
North American Vertical Datum of 1988	NAVD 88
Not Commissioned	NCM
Note to Exceed	NTE
Notice to Airmen	NOTAM

WORD/ PHRASE	CONTRACTION
O	
Observation	OBS
Obstruction	OBST
Obstruction Identification Surface	OIS
Obstruction Lighted	OL
Obstruction Light On	OL ON
Omnidirectional Approach Light System	ODALS
Orthometric	ORTHO
Out Of Service	OTS
Outer Marker	OM
P	
Point of Contact	POC
Permanent Survey Mark	PSM
Precision Approach Path Indicator	PAPI
Precision Approach Radar	PAR
Primary Airport Control Station	PACS
Pulsating Visual Approach Slope Indicator	PVASI
Q	
None	
R	
Railroad	RR
Reflector	RFLTR
Relocated	RELCTD
Remote Communications Outlet	RCO
Remote Transmitter/Receiver	RTR
Road	RD
Road (Noninterstate)	RD (N)
Road (Interstate)	RD (I)
Runway	RWY
Runway Alignment Indicator Lights	RAIL
Runway End Identifier Lights	REIL
Runway Visual Range	RVR

WORD/ PHRASE	CONTRACTION
S	
Secondary Airport Control Station	SACS
Simplified Directional Facility	SDF
Specially Prepared Hard Surface	SPHS
Stack	STK
Standard Instrument Departure	SID
Standard Terminal Arrival	STAR
Standpipe	SPIPE
Stopway	STWY
T	
Tactical Air Navigation Aid	TACAN
Tank	TK
Taxiway	TWY
Temporary	TMPRY
Threshold	THLD
Take-off Distance Available	TODA
Take-off Run Available	TORA
Touchdown Reflector	TDR
Touchdown Zone	TDZ
Touchdown Zone Elevation	TDZE
Tower	TWR
Transmissometer	TMOM
Transmission Tower	TRMSN TWR
Tri-color Visual Approach Slope Indicator	TRCV
U	
Under Construction	UNC
Until Further Notice	UFN
V	
Vertical	VERT
Vertical Survey Point	VSP
Very High Frequency Omnidirectional Range	VOR
Visual Approach Slope Indicator	VASI
Visual Flight Rules	VFR
Visual Meteorological Conditions	VMC
VOR/Tactical Air Navigation	VORTAC

WORD/ PHRASE	CONTRACTION
W	
Wide Area Augmentation System	WAAS
Wind Direction Indicator	WDI
Wind Tee	WTEE
Wind Tetrahedron	WTET
Windsock	WSK
World Geodetic System of 1984	WGS 84
X	
none	
Y	
none	
Z	
Z Marker	ZM

CONTRACTION	WORD/ PHRASE
A	
ABND	Abandoned
AC	Advisory Circular
ACFT	Aircraft
ADO	Airport District Office
AFD	Airport Facility Directory
AFSS	Automated Flight Service Station
AG	Agricultural
A-GEAR	Arresting Gear
AGL	Above Ground Level
ALP	Airport Location Point
ALS	Approach Light System
AMOM	Anemometer
ANA	Area Navigation Approach
ANT	Antenna
AOC	Airport Obstruction Chart
APBN	Airport Beacon
APCH	Approach
APP LT	Approach Light
ARP	Airport Reference Point
ARPT	Airport
ARSR	Air Route Surveillance Radar
ASDA	Accelerate-Stop Distance Available
ASDE	Airport Surface Detection Equipment
ASOS	Automated Surface Observing System
ASR	Airport Surveillance Radar
ATCT	Airport Traffic Control Tower
AWOS	Automatic Weather Observing/Reporting System
AWYBN	Airway Beacon
B	
BCM	Back Course Marker
BLDG	Building
BRDG	Bridge

CONTRACTION	WORD/ PHRASE
C	
C/L	Centerline
CHY	Chimney
CLOM	Ceilometer
CLSD	Closed
CONST	Construction
CORS	Continuously Operating Reference Station
CTAF	Common Traffic Advisory Frequency
D	
DCLN	Distance to Centerline
DEND	Distance to Runway End
DF	Direction Finder
DME	Distance Measuring Equipment
DTHLD	Displaced Threshold
DTHR	Distance to Threshold
E	
EL	Elevation
ELEC	Electrical
ELEV	Elevation
ELLIP	Ellipsoid
EME	Estimated Maximum Elevation
EOD	Engine Out Departure
EQUIP	Equipment
F	
FLGPL	Flagpole
FM	Fan Marker
FSS	Flight Service Station
G	
GCA	Ground Control Approach
GPS	Global Positioning System
GRD	Ground
GS	Glide Slope

CONTRACTION	WORD/ PHRASE
H	
HAA	Height Above Airport
HAR	Height Above Runway
HAT	Height Above Touchdown
HGR	Hangar
HORZ	Horizontal
HRP	Heliport Reference Point
HSP	Horizontal Survey Point
I	
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
INOP	Inoperative
INTXN	Intersection
ITRF	International Earth Rotation Service Terrestrial Reference Frame
J	
None	
K	
None	
L	
LDIN	Lead In Lighting System
LT	Light
LDA	Localizer Type Directional Aid
LMM	Locator Middle Marker
LOC	Localizer
LOM	Locator Outer Marker
LTD	Lighted

CONTRACTION	WORD/ PHRASE
M	
MCWV	Microwave
MLS	Microwave Landing System
MLSAZ	Microwave Landing System Azimuth Guidance
MLSEL	Microwave Landing System Elevation Guidance
MM	Middle Marker
MON	Monument
MSL	Mean Sea Level
N	
NAD 27	North American Datum of 1927
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NAVAID	Navigational Aid
NCM	Not Commissioned
NDB	Nondirectional Radio Beacon
NFDC	National Flight Data Center
NFDD	National Flight Data Digest
NGS	National Geodetic Survey
NGVD 29	National Geodetic Vertical Datum of 1929
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NOTAM	Notice to Airmen
NSRS	National Spatial Reference System
NTE	Not to Exceed
O	
OBS	Observation
OBST	Obstruction
ODALS	Omnidirectional Approach Light System
OIS	Obstruction Identification Surface
OL	Obstruction Lighted
OL ON	Obstruction Light On
OM	Outer Marker
ORTHO	Orthometric
OTS	Out Of Service

CONTRACTION	WORD/ PHRASE
P	
PACS	Primary Airport Control Station
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
POC	Point of Contact
PSM	Permanent Survey Mark
PVASI	Pulsating Visual Approach Slope Indicator
Q	
None	
R	
RAIL	Runway Alignment Indicator Lights
RCO	Remote Communications Outlet
RD	Road
REIL	Runway End Identifier Lights
RELCTD	Relocated
RFLTR	Reflector
RD (I)	Road (Interstate)
RD (N)	Road (Noninterstate)
RR	Railroad
RTR	Remote Transmitter/Receiver
RVR	Runway Visual Range
RWY	Runway
S	
SACS	Secondary Airport Control Station
SDF	Simplified Directional Facility
SID	Standard Instrument Departure
SPHS	Specially Prepared Hard Surface
SPIPE	Standpipe
STAR	Standard Terminal Arrival
STK	Stack
STWY	Stopway

CONTRACTION	WORD/ PHRASE
T	
TACAN	Tactical Air Navigation Aid
TDR	Touchdown Reflector
TDZ	Touchdown Zone
TDZE	Touchdown Zone Elevation
THLD	Threshold
TK	Tank
TMOM	Transmissometer
TMPRY	Temporary
TODA	Take-off Distance Available
TORA	Take-off Run Available
TRCV	Tri-color Visual Approach Slope Indicator
TRMSN TWR	Transmission Tower
TWR	Tower
TWY	Taxiway
U	
UFN	Until Further Notice
UNC	Under Construction
V	
VAR	Magnetic Variation
VASI	Visual Approach Slope Indicator
VERT	Vertical
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Range
VORTAC	VOR/Tactical Air Navigation
VSP	Vertical Survey Point
W	
WAAS	Wide Area Augmentation System
WDI	Wind Direction Indicator
WGS 84	World Geodetic System of 1984
WSK	Windsock
WTEE	Wind Tee
WTET	Wind Tetrahedron

CONTRACTION	WORD/ PHRASE
X	
None	
Y	
None	
Z	
ZM	Z Marker

APPENDIX 7

SAMPLE AIRPORT OBSTRUCTION CHART

A SAMPLE AIRPORT OBSTRUCTION CHART (OC 000)
IS FOLDED INSIDE THE BACK COVER

GLOSSARY

GLOSSARY

A,B,C

Accuracy - The degree of conformity with a standard, or a value accepted as correct. Precision is the degree of uniformity of repeated measurements or events. For example, repeat measurements of the distance between two points may exhibit a high degree of precision by virtue of the relative uniformity of the measurements. However, if a "short" tape were used in the measurements, accuracy would be poor in that the measured distance would not conform to the true distance between the points.

Surveying and mapping accuracy standards should include three elements: (1) a stated variation from a true value or a value accepted as correct, (2) the point to which the new value is relative, and (3) the probability that the new value will be within the stated variation. For example, "Horizontal accuracy will be 10 cm relative to the nearest Continuously Operating Reference Station (CORS) at the 95 percent confidence level."

Abeam Point - The point on a line that is nearest to an off line point. For example, a point on the runway centerline is "abeam" the Glide Slope Antenna when the distance from the centerline point to the antenna is a minimum.

Accelerate-Stop Distance Available - (ASDA) The runway plus stopway length declared available and suitable for the acceleration and deceleration of an airplane aborting a takeoff.

Aeronautical Beacon - A visual navigational aid dispaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a federal airway in mountainous terrain, or an obstruction. (See Airport Rotating Beacon under Airport Lighting.)

Air Navigation Facility - Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and takeoff of aircraft. (See Navigational Aid.)

Airport - An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

Airport Elevation - The highest point of an airport's usable runways measured in feet from mean sea level (technically, from the vertical datum.)

Airport Lighting - Various lighting aids that may be installed on an airport. Types of airport lighting include:

Airport Rotating Beacon (APBN) - A visual navigational aid operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes.

Approach Light System (ALS) - An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his final approach for landing. Condenser-Discharge Sequential Flashing Lights/Sequenced

Flashing Lights may be installed in conjunction with the ALS at some airports

Omnidirectional Approach Light System (ODALS) - Seven omnidirectional flashing lights located in the approach area of a nonprecision approach. Five lights are located on the runway centerline extended with the first light located 300 feet from the threshold and extending at equal intervals up to 1,500 feet from the threshold. The other two lights are located, one on each side of the runway threshold, at a lateral distance of 40 feet from the runway edge, or 75 feet from the runway edge when installed on a runway equipped with a VASI.

Runway Alignment Indicator Lights (RAIL) - Sequenced Flashing Lights which are installed only in combination with other light systems.

Runway End Identifier Lights (REIL) - Two Synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

Precision Approach Path Indicator (PAPI) - A visual approach slope indicator normally consisting of light units similar to the VASI but in a single row of either two or four light units set perpendicular to the runway centerline. The row of light units is normally installed on the left side of the runway. Indications are as follows: Below glide path - all lights red; Slightly below glide path - three lights closest to runway red, other light white; On glide path - two lights closest to runway red, other two lights white; Slightly above glide path - light closest to runway red, other three lights white; Above glide path - all lights white.

Pulsating Visual Approach Slope Indicator (PVASI) - A pulsating visual approach slope indicator normally consisting of a single light unit projecting a two-color visual approach path into the final approach area of the runway upon which the indicator is installed. The on glide path indication is a steady white light. The slightly below glide path indication is a steady red light. If the aircraft descends further below the glide path, the red light starts to pulsate. The above glide path indication is a pulsating white light. The pulsating rate increases as the aircraft gets further above or below the desired glide slope.

Tri-Color Visual Approach Slope Indicator (TRVC) - A visual approach slope indicator normally consisting of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indication is green.

Visual Approach Slope Indicator (VASI) - An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot is ""on path" if he sees red/white, "above path" if white/white, and "below path" if red/red. Some airports serving large aircraft have three-bar VASI's which provide two visual glide paths to the same runway.

Airport Location Point (ALP) - The permanent position, usually expressed in latitude and longitude, of an airport for identification and reference purposes. The ALP coincides with the original Airport Reference Point. (See Airport Reference Point.)

Airport Reference Point (ARP) - The approximate geometric center of all usable runways. ARP is not monumented, therefore not recoverable on the ground.

Airport Surface Detection Equipment (ASDE) - Radar equipment specifically designed to detect all principal features on the surface of an airport, including aircraft and vehicular traffic, and to present the entire image on a radar indicator

console in the control tower. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on the runways and taxiways.

Airport Surveillance Radar (ASR) - Approach control radar used to detect and display an aircraft's position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 nautical miles.

Air Route Surveillance Radar (ARSR) - Air route traffic control center (ARTCC) radar used primarily to detect and display an aircraft's position while en route between terminal areas.

Air Route Traffic Control Center (ARTCC) - A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

Apron - A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

Area Navigation - A method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigational signals or within the limits of a self-contained system capability. Area navigation systems include GPS, Inertial, and LORAN-C.

Area Navigation Approach (ANA) - An instrument approach procedure using an Area Navigation System.

Azimuth

Astronomic - At the point of observation, the angle measured from the vertical plane through the celestial pole and the vertical plane through the observed object. The astronomic azimuth is established directly from observations on a celestial body and is measured in the plane of the horizon. Astronomic azimuths differs from geodetic azimuths because of the deflection of the vertical which can be greater than one minute of arc in extreme cases. Astronomic azimuths may be reckoned clockwise or counterclockwise, from either north or south, as established by convention.

Geodetic - The angle at point A between the tangent to the meridian at A and the tangent to the geodesic from A to B whose geodetic azimuth is wanted. It may be reckoned clockwise from either geodetic north or south as established by convention. Because of earth curvature, the geodetic azimuth from A to B (forward azimuth) differs from the geodetic azimuth from B to A (back azimuth) by other than 180 degrees, except where A and B have the same geodetic longitude or where the geodetic latitude of both points is zero. The geodesic line is the shortest surface distance between two points on the reference ellipsoid. A geodetic meridian is a line on the reference ellipsoid defined by the intersection of the reference ellipsoid and a plane containing the minor axis of that ellipsoid.

Grid - The angle in the plane of projection between a straight line and the central meridian of a plane-rectangular coordinate system. Grid azimuths may be reckoned clockwise from either geodetic north or south as established by convention.

Magnetic - At the point of observation, the angle between the vertical plane through the observed object and the vertical plane in which a freely suspended symmetrically magnetized needle, influenced by no transient artificial magnetic disturbance, will come to rest. Magnetic azimuths are reckoned clockwise from magnetic north.

Bench Mark - A relatively permanent natural or artificial material object bearing a marked point whose elevation above or below an adopted surface (datum) is known.

Blast Fence - A barrier that is used to divert or dissipate jet or propeller blast.

Blast Pad - A specially prepared surface placed adjacent to the ends of runways to eliminate the erosive effect of the high wind forces produced by airplanes at the beginning of their takeoff rolls.

Catenary - The curve theoretically formed by a perfectly flexible, uniformly dense and thick, inextensible cable suspended from two points. Also a cable suspended between two points and having the approximate shape of a catenary.

Clearway - An area beyond the takeoff runway under the control of airport authorities within which terrain or fixed obstacles may not extend above specified limits. These areas may be required for certain turbine-powered operations and the size and upward slope of the clearway will differ depending on when the aircraft was certificated.

Compass Locator - A low power, low or medium frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as authorized in the approach procedure.

Control Station - A point on the ground whose position and/or elevation is used as a basis for obtaining positions and/or elevations of other points.

Continuously Operating Reference Station (CORS) - A permanent GPS facility whose GPS receiver continuously provides observables from the GPS satellites, allowing stations occupied temporarily by GPS receivers to be differentially positioned relative to it. CORS are related to the NAD 83 coordinate system at the 1-3 cm level either by being collocated at VLBI sites which were used to define the coordinate system, or by being differentially positioned relative to such a collocated GPS station.

D, E, F

Datum - In general, a point, line, surface, or set of values used as a reference. A geodetic datum is a set of constants specifying the coordinate system and reference used for geodetic control (See Control Station), ie, for calculating coordinates of points on the earth. At least eight constants are needed to form a complete datum: three to specify the location of the origin of the coordinate system; three to specify the orientation of the coordinate system; and two to specify the dimensions of the reference ellipsoid. Any point has a unique X,Y,Z datum coordinate which can be transformed into latitude, longitude, and ellipsoid height (height relative to the ellipsoid).

A horizontal control datum is a geodetic datum specified by two coordinates (latitude and longitude) on the ellipsoid surface, to which horizontal control points are referenced.

A vertical datum is a theoretical equipotential surface with an assigned value of zero to which elevations are referenced. (See Geoid).

Datum Tie - The process of determining, through appropriate survey methods, a position (horizontal tie) or elevation (vertical tie) of a new point relative to the position/elevation of a control station with established datum values, such as, a control station in the National Spatial Reference System (NSRS). The new point may be a permanent survey monument. This process ensures that the new point will have the proper relationship to NSRS and to all other points tied to NSRS.

Direction Finder (DF) - A radio receiver equipped with a directional sensing antenna used to take bearings on a radio transmitter.

Distance Measuring Equipment (DME) - Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid. DME is usually frequency paired with other navigational aids, such as a VOR or localizer.

Ellipsoid - See Reference Ellipsoid

Ellipsoid Height - The distance, taken along the perpendicular to the ellipsoid, between a point and the reference ellipsoid. Ellipsoid heights are positive if the point is above the ellipsoid. Ellipsoid heights are the heights resulting from GPS observations. Ellipsoid height = Geoid Height + Orthometric Height.

Federal Base Network (FBN) - A fundamental reference network of permanently monumented control stations in the United States at a 1 degree x 1 degree nominal spacing, established, maintained, and monitored by the National Geodetic Survey, providing precise latitude, longitude, ellipsoidal height, orthometric height, and gravity values. The FBN is a very precise subset of the National Spatial Reference System.

Flight Path - A line, course, or track along which an aircraft is flying or intended to be flown.

Frangible Fixture - A fixture designed to break at a predetermined point when struck by a predetermined force to minimize damage if accidently struck by an aircraft.

G, H, I

Geoid - The theoretical surface of the earth that coincides everywhere with approximate mean sea-level. The geoid is an equipotential surface to which, at every point, the plumb line is perpendicular. Because of local disturbances of gravity, the geoid is irregular in shape.

Geoid Height - The distance, taken along a perpendicular to the reference ellipsoid, between the reference ellipsoid and the geoid. The geoid height is positive if the geoid is above the reference ellipsoid. (Geoid height is negative for the conterminous United States). Geoid Height = Ellipsoidal Height - Orthometric Height.

Global Positioning System (GPS) - A space-based radio positioning, navigation, and time-transfer system. The system provides highly accurate position and velocity information, and precise time, on a continuous global basis, to an unlimited number of properly equipped users.

Ground Controlled Approach (GCA) - A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with airport surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR).

Helipad - A small designated area, usually with a prepared surface, on a heliport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

Heliport - An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities if any.

Heliport Reference Point (HRP) - The geographic position of the heliport expressed in latitude and longitude at, (1) the center of the final approach and takeoff (FATO) area or the centroid of multiple FATO's for heliports having visual and nonprecision instrument approach procedures, or (2) the center of the final approach reference area when the heliport has a precision instrument approach.

Instrument Landing System (ILS) - A precision instrument approach system which normally consists of the following electronic components and visual aids:

Localizer
Glide Slope
Outer Marker
Middle Marker
Approach Lighting

Instrument Runway - A runway equipped with electronic and visual navigational aids for which a precision or nonprecision approach procedure having straight-in landing minimums have been approved.

International Civil Aviation Organization (ICAO) - A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

J, K, L

Landing Area - Any locality either on land, water, or structure, including airports/heliports, and intermediate landing fields, which is used, or intended to be used, for the landing and takeoff of aircraft whether or not facilities are provided for shelter, servicing, or for receiving or discharging passengers or cargo.

Landing Direction Indicator - A device, usually a tetrahedron, which visually indicates the direction in which landings and takeoffs should be made.

Leveling - The process of determining the difference in elevation between two points. In geodetic leveling, this process results in a vertical distance from a vertical datum.

Direct - The determination of differences in elevation by means of a series of horizontal observations on a graduated rod. The leveling instrument maintains a horizontal line of sight through spirit leveling or a compensation mechanism. The rod is observed while it is resting on a point of known elevation (backsight) and then, without disturbing the elevation of the leveling instrument, is observed a second time while resting on the unknown point (foresight). The differential in rod readings is applied to the starting elevation to determine the elevation of the unknown.

Indirect - The determination of differences in elevation by means other than differential leveling, such as, trigonometric leveling. In trigonometric leveling, the vertical angle and distance from the instrument to the point of unknown elevation are measured and the difference in elevation between the instrument and the unknown point is then computed using trigonometry.

Local Control - A control station or network of control stations in a local area used for referencing local surveys. Local control may or may not be tied to the National Spatial Reference System. (See Control Station).

Localizer (LOC) - The component of an ILS which provides course guidance to the runway.

Localizer Type Directional Aid (LDA) - A navigational aid used for nonprecision instrument approaches with utility and accuracy comparable to a localizer but which is not part of a complete ILS and is not aligned with the runway.

Long Range Navigation (LORAN) - An electronic navigation system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. LORAN A operates in the 1750 - 1950 kHz frequency band. LORAN C and D operate in the 100 - 110 kHz frequency band.

M, N, O

Marker Beacon - An electronic navigational facility transmitting a 75 MHz vertical fan or boneshaped radiation patter to be received by aircraft flying overhead.. Marker beacons are identified by their modulation frequency and keying code, and when received by compatible airborne equipment, indicate to the pilot, both aurally and visually, that he is passing over the facility.

Inner Marker (IM) - A marker beacon, used with an ILS Category II precision approach, located between the middle marker and the end of the ILS runway and normally located at the point of designated decision height, normally 100 feet above the touchdown zone elevation, on the ILS Category II approach. It also marks progress during a ILS Category III approach.

Middle Marker (MM)- A marker beacon that defines a point along the glideslope of an ILS, normally located at or near the point of decision height for ILS Category I approaches.

Outer Marker (OM) - A marker beacon at or near the glideslope intercept altitude of an ILS approach. The outer marker is normally located four to seven miles from the runway threshold on the extended centerline of the runway.

Mean Sea Level (MSL) - The average location of the interface between the ocean and atmosphere, over a period of time sufficiently long so that all random and periodic variations of short duration average to zero.

Minimum Safe Altitude Warning (MSAW) - A function of the ARTS III computer that aids the controller by alerting him when a tracked Mode C equipped aircraft is below or is predicted by the computer to go below a predetermined minimum safe altitude.

Minimums - Weather condition requirements established for a particular operation or type of operation; e.g., IFR takeoff or landing, alternate airport for IFR flight plans, VFR flight etc.

Missed Approach - A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing.

Movement Area - The runways, taxiways, and other areas of an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC.

National Airspace System (NAS) - The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations, and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

National Flight Data Center (NFDC) - A facility in Washington, D.C., established by FAA to operate a central aeronautical information service for the collection, validation, and dissemination of aeronautical data in support of the activities of government, industry, and the aviation community. The information is published in the "National Flight Data Digest."

National Flight Data Digest (NFDD) - A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

National Spatial Reference System (NSRS) - A network of permanent survey monuments located throughout the United States with accurately determined positions (horizontal network) and/or elevations (vertical network). Gravity values, not always monumented, are also part of NSRS.

Responsibility for establishing and maintaining NSRS rests with the National Geodetic Survey under the U.S. Department of Commerce. Current authority is contained in United States Code, Title 33, USC 883a as amended, and specifically defined by Executive Directive, Bureau of the Budget (now Office of Management and Budget) Circular No. A-16 Revised.

Navigable Airspace - Airspace at and above the minimum flight altitude prescribed in the FARs, including airspace needed for safe takeoff and landing.

Navigational Aid (NAVAID) - Any visual or electronic device airborne or on the surface which provides point to point guidance information or position data to aircraft in flight. (See Air Navigation Facility.)

Nondirectional Beacon (NDB) - An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" or track to or from the station. When the NDB is installed in conjunction with an Instrument Landing System marker, it is normally called a Compass Locator.

Nonprecision Approach Procedure - A standard instrument approach procedure in which no electronic glide slope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDS, and SDF approaches.

Notice to Airmen (NOTAM) - A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

Obstruction - Any object that penetrates an obstruction identification surface.

Obstruction Identification Surface (OIS) - Any imaginary surface authorized by the Federal Aviation Administration to identify obstructions. Any object that penetrates an OIS is an obstruction, by definition.

Specified OIS - Any OIS other than a supplemental OIS.

Supplemental OIS - An OIS designated by appropriate FAA authorities as a supplemental OIS. A supplemental OIS, when implemented, will normally lie below a specified OIS and is intended to provide additional obstruction information. An object that penetrates a supplemental OIS only is a supplemental obstruction.

Offset NAVAID - A NAVAID used during the final approach segment of a straight in instrument approach and not located on the runway centerline or centerline extended.

Orthometric Height - The distance, taken along the plumb line, between a point and the geoid. Orthometric heights are positive if the point is above the geoid. Orthometric Height = Ellipsoid Height - Geoid Height.

P, Q, R

Planimetry - The plan detail of a map that has no indication of relief or contour.

Plot Point - A point that represents the position of a feature. This point may be located on the feature or located between feature components. For example, the plot point for a Precision Approach Path Indicator (PAPI) system is the center of the light array which falls between light units.

Precision Approach Procedure - A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; e.g., GPS, ILS, and PAR approaches.

Precision Approach Radar (PAR) - Radar equipment, in some ATC facilities operated by FAA and/or the military services at joint use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), glidepath (elevation), and distance (range) from the touchdown point on the runway as displayed on the radar scope.

Primary Airport Control Station (PACS) - A control station established in the vicinity of, and usually on, an airport, and tied directly to the National Spatial Reference System. PACS must be declared PACS by the National Geodetic Survey and must meet the specific siting, construction, and accuracy requirements for PACS.

Progressive Taxi - Precise taxi instructions given to a pilot unfamiliar with the airport or issued in stages as the aircraft proceeds along the taxi route.

Published Data - Data officially issued for distribution to the public.

Radio Detection and Ranging (RADAR) - A device which, by measuring the time interval between transmission and reception of radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation, provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulse.

Primary Radar - A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at the site for processing and display at an air traffic control facility.

Secondary Radar/Radar Beacon (ATCRBS) - A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the transmitter/receiver site for processing and display at an air traffic control facility.

Radar Approach - An instrument approach procedure which utilizes Precision Approach Radar (PAR) or Airport Surveillance Radar (ASR).

Radio Beacon - See Nondirectional Beacon

Ramp - See Apron

Reference Ellipsoid - A geometric figure comprising one component of a geodetic datum, usually determined by rotating an ellipse about its shorter (polar) axis, and used as a surface of reference for geodetic surveys. The reference ellipsoid closely approximates the dimensions of the geoid, with certain ellipsoids fitting the geoid more closely for various areas of the earth. Elevations derived directly from satellite observations are relative to the ellipsoid and are called ellipsoid heights.

Remote Communications Outlet (RCO) - An unmanned communications facility remotely controlled by air traffic personnel. RCO's serve flight service stations. Remote Transmitter/Receivers (RTR) serve terminal ATC facilities.

Remote Transmitter/Receiver (RTR) - See Remote Communications Outlet.

Runway - A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees: e.g., Runway 10, Runway 25.

Runway Length - The straight line distance between runway end points. This line does not account for surface undulations between points. Official runway lengths are normally computed from runway end coordinates and elevations.

S, T, U

Secondary Airport Control Station (SACS) - A control station established in the vicinity of, and usually on, an airport, and tied directly to the Primary Airport Control Station. SACS must be declared SACS by the National Geodetic Survey and must meet the specific siting, construction, and accuracy requirements for SACS.

Simplified Directional Facility (SDF) - A navigational aid used for nonprecision instrument approaches. The final approach course is similar to that of an ILS localizer except that the SDF course may be offset from the runway, generally not more than 3 degrees, and the course may be wider than the localizer, resulting in a lower degree of accuracy.

Specially Prepared Hard Surface (SPHS) - A concrete, asphalt, or other paved surface, or an unpaved surface that has been specially treated to stabilize the surface, protect the subsurface, or provide a smoother rolling surface for aircraft. Unpaved SPHS's include compacted gravel, and gravel treated with a stabilizing bituminous material.

State Plane Coordinate System - A series of plane-rectangular coordinate systems established by the U.S. Coast and Geodetic Survey for the entire United States, with a separate system for each state. A mathematical relationship exists between state plane and geodetic coordinates, one being easily transformed into the other. The advantage of the State Plane Coordinate System is that it permits survey computations for small areas to be performed using plane trigonometry (as opposed to more complex spherical trigonometry), while still yielding very nearly the true angles and distances between points.

Stopway - An area beyond the takeoff runway, no less wide than the runway and centered upon the extended centerline of the runway, able to support the airplane during an aborted takeoff, without causing structural damage to the airplane, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff.

Supplemental Profile Point - A runway/stopway point selected so that a straight line between any two adjacent published runway/stopway points will be no greater than one foot from the runway/stopway surface.

Take-off Distance Available (TODA) - The length of the take-off run available plus the length of the clearway, if provided.

Take-off Run Available (TORA) - The length of the runway declared available and suitable for the ground run of an aeroplane take-off.

Tactical Air Navigation (TACAN) - An ultra-high frequency electronic rho-theta air navigational aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station.

Tetrahedron - A device normally located on uncontrolled airports and used as a landing direction indicator. The small end of the tetrahedron points in the direction of landing.

Threshold (THLD) - The beginning of that portion of the runway available for landing. A displaced threshold (DTHLD) is a threshold that is located at a point on the runway other than the designated beginning of the runway. A relocated threshold (RTHLD) is a threshold that is located at the runway end but not at the end of pavement.

Touchdown Zone (TDZ) - The first 3,000 feet of the runway beginning at the threshold.

Touchdown Zone Elevation (TDZE) - The highest elevation in the Touchdown Zone.

Transmissometer (TMOM) - An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR) and runway visibility value (RVV).

V, W, X, Y, Z

V_1 - The takeoff decision speed. If a system failure occurs before V_1 the takeoff is aborted. If the failure occurs at or above V_1, the pilot is committed to continue the takeoff.

Vertical Takeoff and Landing (VTOL) Aircraft - Aircraft capable of vertical climbs and/or descents and of using very short runways or small areas for takeoff and landings. These aircraft include, but are not limited to, helicopters.

Very High Frequency Omnidirectional Range Station (VOR) - A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north.

Very High Frequency Omnidirectional Range/Tactical Air Navigation (VORTAC) - A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site.

Visual Approach - An approach conducted on an instrument flight rules (IFR) flight plan which authorizes the pilot to proceed visually and clear of clouds to the airport. The pilot must, at all times, have either the airport or preceding aircraft in sight.

Visual Glideslope Indicator - A navigational aid that provides vertical visual guidance to aircraft during approach to landing by either radiating a directional pattern of high intensity light into the approach area, or providing lighted or unlighted panels which can be aligned by the pilot, thereby allowing the pilot to determine if the aircraft is above, below, or on the prescribed glidepath. (See Airport Lighting).

Waypoint - A predetermined geographical position used for route/instrument approach definition, or progress reporting purposes, that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.

Wide Area Augmentation System (WAAS) - The total FAA system designed and built to meet the mission needs of insuring satellite integrity for using GPS for required navigation performance (RNP) in the National Airspace System and of improving accuracy to support precision approaches using GPS augmented with the WAAS.