Appendix C
NAVAIDS Table

Proposed Navigational Aids Equipment and Structures

Equipment	Purpose	Footprint Description	Siting Criteria
Remote Transmitter/Receiver (RTR)	Provides communications between air traffic control specialists and pilots in the terminal airspace.	Typical 140 feet by 140 feet site includes four antenna towers and one equipment building, which may contain an engine generator.	Three siting criteria are surrounding terrain, ground conductivity, and ambient radio frequency noise.
Tactical Aircraft Control and Navigation (TACAN) at Very High Frequency Omnidirectional Range (VOR) TACAN only (TACR)	TACAN provides Omnidirectional azimuth information primarily for military users of the national air space and distance information to all national air space users.	TACR has footprint similar to that of VOR.	Same as for VOR.
Tower Building (TOWB)	Provides a support structure and/or accommodation for supplemental facilities for an ATCT	Same as for ATCT.	Same as for ATCT.
Visual Approach Slope Indicator (VASI)	Provides visual approach slope information.	Footprint depends on configuration. A VASI can be two-bar or three-bar VASI system. Two-bar system light units are arranged in bars called upwind (farthest from the threshold) and downwind (nearest to the threshold) bar. A VASI-2 is a two-bar system consisting of two light units, one unit in each bar. A VASI-4 consists of four light units, two units in each bar. A VASI-12 consists of twelve light units, six light units in each bar. Three-bar system light units are arranged in bars called the upwind, middle, and	A two-light unit VASI can be accommodated in a footprint with overall dimensions, in the case of two-bar VASIs, of approximately four feet by 700 feet, plus 300 feet or minus 200 feet. Units with more box units would have the same length dimensions, with spacing between boxes within the upwind bar and downwind bar of sixteen feet, plus or minus six feet. Three-bar VASIs would encompass an additional length of 700 feet, plus 300 feet or minus 200 feet. All light units of the two-box, four-box,

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		downwind bar. There are two glide paths projected by the three-bar system that are seen by the pilot, the upwind zone for long-bodied aircraft and the downwind zone for other aircrafts. A VASI-6 consists of six light units, two light units in each bar. A VASI-16 consists of 16 light units, six light units in the downwind and middle bars, and four light units in the upwind bar.	and six-box configurations are typically located on the left side of the runway (as viewed from the approach direction). Where terrain or cross runways, etc., make this impractical, they may be located on the right side of the runway. VASIs are located fifty feet, plus or minus ten feet, to the side of the runway. FAA Order 6850.2A figures show layouts of the different VASI configurations.
Very High Frequency Omnidirectional Range (VOR)	Provides separate am and fm signals to the airborne avionics to determine the azimuth of the aircraft from the VOR site at a given time.	A typical VOR site will require use of approximately 72 acres. • With few exceptions, all obstructions within a 1000 feet radius of the antenna must be removed. Normal grazing and crop raising may be permitted in this area, except at mountain top facilities where antennas are four feet high. • Single trees (up to 30 feet in height) may be tolerated beyond 500 feet. At mountain top sites, no trees within 1000 feet should be visible from the antenna array. • Ordinary farm-type wire fences about four feet high are not permitted within 200 feet of the antenna; chain type fences (six feet or more in height) are not permitted within 500 feet of the antenna. • Power and control line extensions	If on airport, should be located in an area adjacent to the intersection of the principle runways in order to provide approach guidance to the ends of these runways. It should not be located closer than 500 feet to the centerline of any runway or 250 feet to the centerline of a taxiway. And, no part of the facility shall penetrate any surface defined in paragraphs 77.25, 77.28, or 77.29 of the Federal Aviation Regulations. If off airport, consider selecting a site so that one or more of the course radials will provide an approach procedure to the primary bad weather runway in accordance with FAA Order 8260.3B. Other considerations include ground slope and ground smoothness, nearby structures and objects such as long wires, trees, cylinders, planes, and combinations of these.

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		should be installed underground for a minimum distance of 600 feet from the antenna. Overhead power and control lines may be installed beyond 600 feet but should be essentially radial to the antenna for a minimum distance of 1200 feet.	
Automatic Surface Observation System (ASOS)	ASOS provides weather observations that include: temperature, dew point, wind, altimeter setting, visibility, sky condition, and precipitation.	Specific footprint depends upon the type of sensor, whether the airport has precision instrument runways, and whether the sensors are on-airport or off-airport. Typically, sensors are on-airport and occupy an area of 50 feet by 50 feet.	ASOS sensor sighting must not violate runway or taxiway object free areas, runway or taxiway safety areas, obstacle free zones or instrument flight procedures surfaces. Notwithstanding these constraints, sensor exposure should minimize or eliminate effects of manmade or geographical obstructions. The tower used to mount the wind sensor is not considered an obstruction to the sensor collection system, but it will (with the exception of the temperature, dew point, and pressure sensors) be at least 3 meters away from other sensors. Sensors should be placed as far away as practicable from cultivated land to reduce contamination by dust and dirt. It may be necessary to increase the heights of some sensors based on the average maximum show depth for the location. Specific siting information is in FAA Order 6560.20B and in the U.S. Department of Commerce/National Oceanic and Atmospheric Administration Office of the Federal Coordinator for Meteorological

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			Services and Supporting Research standard entitled "***Federal Standard for Siting Meteorological Sensors at Airports FCM-S4-1987"***.
Airport Traffic Control Tower (ATCT)	Provides an observation platform from which air traffic controllers direct air and ground traffic for the airport.	A typical ATCT site will range from 4 to 6 acres. Additional land may be needed for combined flight service stations/towers.	• There must be maximum visibility of the airport's traffic patterns. • There must be a clear, unobstructed, and direct line of sight to the approaches, to all runways or landing areas, and to all runway and taxiway surfaces. • A tower penetrating an FAR Part 77 surface is an obstruction to air navigation. As such, it is presumed to be a hazard to air navigation until an FAA study determines otherwise. • The ATCT must not derogate the signal generated by any existing or planned electronic NAVAID or an ATC facility. • The proposed site must be large enough to accommodate current and future building needs, including employee parking spaces.
Glide Scope (GS)	Radiates an electronic signal from an antenna above a reflecting surface. The reflected signal travels to the receiving antenna of incoming aircraft. Pilot	Includes an antenna tower, a 10-foot x 12-foot fiberglass equipment shelter, and a cleared and uniformly graded ground reflective plane for the broadcast signal. Tower height may be up to 65 feet, depending on terrain and specific type of glide slope system used. GS is	Glide slope is located on a line parallel to the runway centerline. The glide slope may be located on either side of the runway. Most reliable operation occurs when it is on the side that provides the least interference from buildings, power lines, moving vehicles, and aircraft and

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	uses the reflected radiation signal to fly a prescribed angle of descent to the runway.	connected to the adjacent taxiway by a paved road. The ground reflective plane measures approximately 300 feet x 1,200 feet.	which has the greatest extent of smooth terrain outbound from the antennas. Glide slopes should be a minimum of 400 feet from the runway centerline.
Localizer (LOC)	Provides horizontal course guidance during an approach procedure. The horizontal guidance information indicates to the pilot of incoming aircraft whether the aircraft is right of, left of, or aligned with the runway centerline.	Antenna width may vary from 45.5 feet to 105 feet (perpendicular to the runway). A equipment shelter (typically 8' x 16') is required to support the LOC. Category II and III localizer systems include a far field monitor.	Localizer is normally near the end of the runway opposite the desired approach. Minimum distance from the stop end of the runway is the greater of 600 feet or the end of the runway safety area. When sufficient area is available, the localizer will be beyond 1000 feet from the stop end of the runway. Maximum standard distance from the stop end of the runway to the LOC is 2000 feet. The equipment shelter must not be within 250 feet of the extended runway centerline and should be within ±30 degrees of the antenna's longitudinal axis. FFM is sited at the opposite end of the runway from the localizer, often near the inner or middle marker.
Locator Outer Marker (LOM)	In precision approaches, there may be an NDB collated with the OM. If so, the marker is referred to as the locator outer marker (LOM). Indicates a position at which an aircraft at the appropriate altitude on the localizer course would intercept runway	Same as for outer marker.	The LOM is located at the outer marker site.

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	glide slope, and the non-directional beacon (NDB) radiates a signal which provides directional guidance to and from the transmitting antenna.		
Medium Intensity Approach Lighting System and Runway Alignment Indicator Lights (MALSR)	Provides visual information on runway alignment, height perception, roll guidance, and horizontal references as the FAA standard for category I precision landings.	2400 feet in length when the glide slope is 2.75 degrees or greater; 3000 feet when the glide slope is less than 2.75 degrees. The approach light plane is 400 feet wide centered on the extended runway centerline, runway alignment indicator lights (RAIL) excepted. The primary plane of the RAIL extends 200 feet beyond the last flashing light in the RAIL and has a total width in the RAIL portion of 100 feet.	The power and control station must be no closer than 400 feet to the MALSR centerline. Typically, this is located 1000 feet from the runway threshold.
Outer Marker (OM)	Indicates a position at which an aircraft at the appropriate altitude on the localizer course would intercept runway glide slope.	Compact marker beacon system consists of a vertical stacked array antenna and a small solid state transmitter with a battery pack standby power source designed for mounting on a standard telephone pole. If siting problems (e.g., prevalent vandalism) dictate need for a marker plot, a 6 foot by 6 foot plot will be used. Most solid-state markers are housed in a transportable shelter. The shelter is approximately 6 by 6 or 8 by 8 feet. A fenced 16 by 18-foot plot is used for these shelters.	4 to 7 nautical miles from threshold (with tolerance of ±800 feet both longitudinal and lateral).
Remote CommunicationsRCO	Provides communication	Typically collocated, frequently with VOR.	Three siting criteria are surrounding terrain, ground conductivity, and ambient

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	between pilots and AFSS for weather and flight plans.		radio frequency noise.
Runway End Identifier Lights (REIL)	Provides rapid and positive identification of the end of a runway.	Each REIL light unit is typically mounted on a pad approximate dimensions of three feet by three feet.	Optimum location is 40 feet from each runway edge and in line with the existing runway threshold lights. Light units may be located laterally up to 75 feet from the runway edge and longitudinally up to 30 feet downwind and 100 feet upwind from the line of threshold lights.
Precision Approach Path Indicator (PAPI)	Furnishes the pilot with visual approach slope information to provide guidance for safe descent.	Basic configuration consists of four lamp housing assemblies (LHAs) arranged on a single bar on a line perpendicular to the runway centerline.	LHAs are located on the left side of the runway, as viewed from the approach direction. Where terrain, cross runways, or taxiways make this arrangement impractical, the LHAs may be located on the right side of the runway. The PAPI must be sited and aimed so that it defines an approach path with adequate clearance over obstacles and a minimum threshold crossing height. The PAPI is typically located approximately 1000 feet past the runway threshold. The inboard LHAs shall be no closer than 50 feet from the runway edge or to other runways or taxiways. The PAPI LHAs must have a lateral separation of 30 feet, and the distance between LHAs shall not vary by more than one foot.