

Appendix K - Navigational Aids

Introduction

This appendix discusses the existing and required airport navigational aids (NAVAIDs) at Black Hills Airport - Clyde Ice Field. NAVAIDs are any ground or satellite based electronic or visual device to assist pilots with airport operations. They provide for the safe and efficient operations of aircraft on an airport or within the vicinity of an airport. NAVAID types at or near the airport evaluated in this appendix include:

- Area Navigation
- Runway Approach
- Airfield Visual
- Meteorological
- Communications

The type of NAVAIDS required on an airport are determined by FAA guidance based on an airport's location, activity and usage type. Available FAA guidance can be found by reviewing the latest Advisory Circulars, Handbooks and Orders.

Area Navigation NAVAIDs

There are several different types of ground and/or satellite based NAVAIDs that provide guidance to aircraft in the air. The FAA owns and maintains the majority of the navigational aids in the United States; however, some are owned and maintained by state or local agencies. En-route NAVAIDs provide navigation assistance to aircraft along a route of flight.

The FAA is updating the nation's air transportation infrastructure through the Next Generation Air Transportation System (NextGen) program. New procedures and technology are to be implemented to improve the efficiency and safety of the national air transportation system. For area navigation, satellite-based NAVAIDs will primarily be used for air navigation with ground-based NAVAIDs used for secondary purposes. Other initiatives include implementing a new surveillance technology for tracking aircraft known as Automatic Dependent Surveillance-Broadcast (ADS-B) to improve position accuracy reporting and supplement ground radar data for air traffic control.

The following NAVAIDs are used by aircraft in and around Black Hills Airport - Clyde Ice Field.

Global Positioning System (GPS)

GPS is a ground and satellite-based navigation system comprised of a network of satellites that transmit radio signals to provide triangulation to ground or air based receivers. Through this triangulation, longitude, latitude, altitude and speed can all be determined. A GPS procedure uses area navigation (RNAV) to help aircraft navigate on a horizontal course through pre-defined GPS waypoints. A series of ground-based transmitters, known as Wide Area Augmentation System (WAAS), enhances the precision of this system allowing receivers

to accurately determine the position of a vehicle within a few horizontal and vertical feet of actual location. This enables precision-like approaches with vertical and horizontal guidance to a runway end. GPS, RNAV and WAAS are used by equipped aircraft for en-route and approach navigation and are widely available for navigation throughout the contiguous United States. This new technology is allowing required navigation performance (RNP) procedures to be developed with three-dimensional waypoints. Future development of Local Area Augmentation System (LAAS) may provide even higher accuracy requirements.

Non-Directional Beacon (NDB)

This beacon is one of the oldest types of navigational technology still used in aircraft navigation. A NDB is simply a low power AM radio station. Aircraft have equipment called Automatic Direction Finder (ADF) which allows the aircraft to tune into the frequency that the NDB is transmitting, and a dial that points a needle to the location of the NDB. NDBs are subject to lightning, precipitation static, and other disturbances that may result in erroneous navigation information. As a result of this and their replacement by GPS, NDB facilities are being decommissioned by FAA.

Black Hills Airport - Clyde Ice Field has an NDB maintained by the airport. The equipment is used for a circling approach to the airport and is the only electronic aid based at the airport.

Recommendations

Other than the NDB there are no locally based electronic navigational aids serving the airport. There are no changes recommended related to these area navigational aids.

Runway Approach NAVAIDs

Other NAVAIDs are developed specifically to provide “approach” navigation guidance, which assists aircraft in landing at a specific airport or runway. These NAVAIDs are electronic or visual in type.

Visual Guidance Slope Indicator (VGSI)

A VGSI system provides visual descent guidance to aircraft on approach to landing. There are several types of VGSI systems available. Examples include a Precision Approach Path Indicator (PAPI) system and a Visual Approach Slope Indicator (VASI). Each system directs beams of red and white light along the approach glide path set at different locations and/or angles to provide pilots with a visual indication of the aircraft’s position relative to the designated approach slope for a runway. VGSI systems have a five mile range during the day and a 20 mile range at night. These systems are typically installed on runway ends with instrument approaches, but are also installed for visual runways. PAPI systems, a newer technology, consist of a single row of two to four lights radiating high intensity red or white beams to indicate whether the pilot is above or below the approach path to the runway.

The airport has 4-box PAPIs on the approach for Runways 13 and 31 and the equipment is maintained by the airport. The lights are pilot controlled and will come on when the Runway lights are activated.

Recommendations

It is recommended to maintain the existing PAPIs for Runway 13-31 and have PAPIs installed on the planned Runway 5-23.

Airfield Visual NAVAIDs

Visual NAVAIDs provide airport users with visual references within the airport environment. They consist of lighting, signage and pavement markings on an airport. Visual NAVAIDs are necessary airport facility components on the airfield, promoting enhancing situational awareness, operational capability and safety.

Airport Beacon

An airport beacon is rotating light that projects a beam of alternating green and white light which appears as a series of flashes to approaching pilots. The airport beacon serves as the airport identification light so approaching pilots can identify the airport location during night and instrument flight rule conditions. The beacon can be visible from 40 miles away at night. The brightness or intensity of beacons can vary by airport. The intensity is dependent upon the amount of ambient light present in the area at night and the runway lighting system installed.

Black Hills Airport - Clyde Ice Field has a rotating beacon located immediately north of the FBO Hangar area.

Runway Lighting

Runway edge lights are placed off the edge of the landing surface of a runway. The lights help pilots define the edges and end of the runway during night and low visibility conditions. These lights are spaced at equal distances along a runway, and perpendicular from side to side of a runway. These lights are generally white in color. The runway end lights appear red to a pilot approaching the end of the runway, and green as aircraft approach the runway from the air. Instrument runways have a row of eight lights at the end of a runway while visual runways have four. For medium and high intensity systems, the last 2,000 feet of each runway with instrument approaches have amber lights to caution pilots that the end of the runway is approaching. The light intensity can be adjusted by use of a radio controlled switch (pilot controlled lighting) on an airport frequency or manually by airport attendants and/or air traffic controllers. Runway lights are classified according to the intensity of light they produce:

- High Intensity Runway Lights (HIRL) are generally installed on precision instrument runways
- Medium Intensity Runway Lights (MIRL) are installed on visual or non-precision instrument runways
- Low Intensity Runway Lights (LIRL) installed on visual runways at small airports

Black Hills Airport - Clyde Ice Field has MIRL on Runway 31-31 which are designed and maintained in accordance with FAA requirements. The lights are pilot controlled.

Taxiway Lighting

Taxiway edge lighting delineates the taxiway and apron edges. Taxiway lights are blue in color and spaced according to FAA standards. Taxiway lights are, by design, of lower intensity than runway lights. The FAA standard taxiway edge lighting system is Medium Intensity Taxiway Lights (MITL).

An economical alternative to taxiway lighting at general aviation airports is the use of retro-reflective markers. These markers are plastic and have blue reflective material designed to reflect light back toward its source.

Black Hills Airport - Clyde Ice Field has MITL on Taxiway A which are designed and maintained in accordance with FAA requirements. The lights are pilot controlled.

Airfield Signage

Airfield signage is essential for the safe and efficient operation of aircraft and ground vehicles on the airport movement area. Signs are located adjacent to the edge of runways, taxiway and aprons. There are several types of signs that each serve a unique purpose. Common signs include:

- Mandatory Instruction Signs are red with white text denoting taxiway/runway intersections, runway/runway intersections, ILS critical areas and other critical areas.
- Location Signs are black with yellow text and identify the taxiway or runway where the aircraft or vehicle is located.
- Boundary Signs are yellow with black text and identify the location of a critical area for a pilot exiting a runway.
- Direction / Destination Signs are yellow with black text containing arrows to indicate the direction of taxiways or general direction to a location.
- Information Signs are yellow with black text and provide additional information to pilots.

The airport has all mandatory instruction signs in accordance with FAA standards and most other recommended signs to aid pilots in location awareness.

Pavement Markings

Pavement markings help airport users visually identify important features on the airfield. Pavement markings are installed on the runways, taxiways and aprons. FAA has defined numerous different pavement markings to promote safety and situational awareness.

Runway

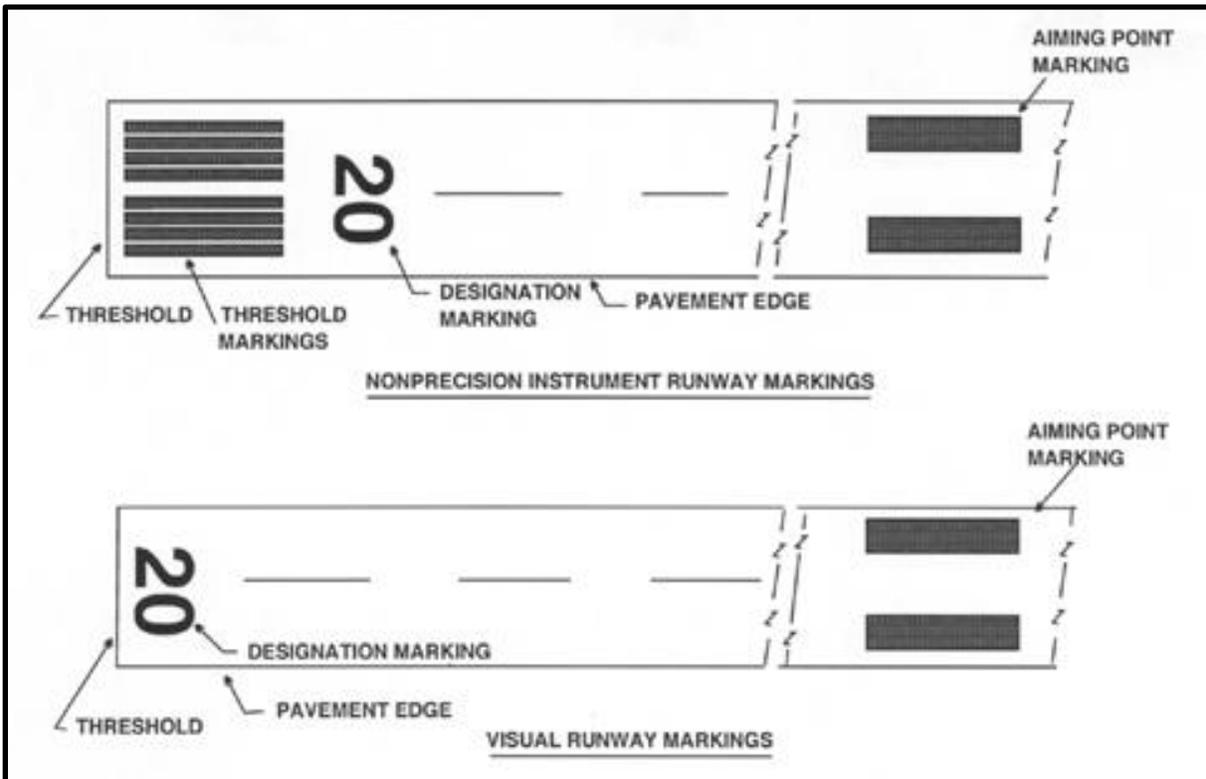
Runway pavement markings are white in color. The type and complexity of the markings are determined by the approach threshold category to the runway end. The minimum required runway markings for a standard runway are as follows:

- Visual (landing designator, centerline)

- Non-Precision (landing designator, centerline, threshold)

The markings at Black Hills Airport - Clyde Ice Field are non-precision for Runway 13-31 and include white boundary cones for the turf runways.

Exhibit K-1 - Runway Markings



Source: FAA Airmen Informational Manual (AIM), Chapter 2

Taxiway & Apron

Taxiway and apron markings are important for directional guidance for taxiing aircraft and ground vehicles. Common taxiway and apron markings include:

- Holding Position Markings are a visual reference to prevent aircraft and vehicles from entering critical areas such as an active runway environment. These markings consist on yellow bars and dashes on a black background.
- Taxiway/Taxilane Centerline is a solid yellow stripe along the designated centerline.
- Taxiway/Taxilane Edge markings are solid or dashed yellow stripes delineating the edge of usable taxiway.
- Non-Movement Area markings delineate the edge of the area controlled by local air traffic control or available for parked aircraft or objects.

Pavement markings should have black borders to help delineate their existence on airport pavements. Some markings require glass beads for enhanced reflectivity.

Black Hills Airport - Clyde Ice Field has all required taxiway markings including hold positions, taxiway centerlines and non-movement area markings on the apron area.

Recommendations

It is recommended to maintain the existing Airfield Visual Aids.

Meteorological Aids

Aircraft operating to and from an airport require meteorological aids to provide current weather data. Weather information helps pilots make informed decision about flight operations. Airports have various aids installed providing local weather information.

Surface Weather Observation

There are various types of surface weather observation stations. An Automated Surface Observation System (ASOS) is a Federal weather reporting station at airports. It provides continuous 24-hour observations and reporting for the FAA, National Weather Service (NWS) and Department of Defense (DoD). The suite of sensors provide temperature, dew point, wind speed and direction, visibility, cloud ceiling and precipitation information. Some stations have optional freezing rain and thunderstorm sensors. An Automated Weather Observation System (AWOS) broadcasts and reports current weather conditions each minute. The suite of sensors varies by type of AWOS. AWOS can be FAA-owned or non-Federally owned. Weather observing systems are recommended to be kept clear of agricultural operations within 100 feet, clear of objects above the 30 foot sensor height within 500 feet, and clear of high objects within 1,000 feet.

The airport has an AWOS-III maintained by the airport and located on the west side of Runway 13-31 across from the FBO hangar area. The unit transmits on 118.325 and can be accessed by phone at 605.642.8536. The weather information for the AWOS-III is reported into the National Weather Service and is available for flight planning from any location.

Wind Cone

Wind cones visually indicate the current wind direction and velocity on an airfield. A primary wind cone is located in a central visible location on the airport and is usually lighted for night operations. A segmented circle is installed around the wind cone to aid pilots in its identification from the air. Supplemental wind cones are installed around the airfield to provide surface wind direction information to pilots where the primary wind cone is not visible. Wind cones must be lit for night air carrier operations.

The airport has a primary windcone with segmented circle located immediately south of the AWOS facility. It is visible from the apron areas and the center of the field.

Recommendations

It is recommended to maintain the existing Meteorological Aids.

Communication Aids

The ability for pilots to communicate with other pilots and air traffic control is critical for the safety and efficiency of the overall air transportation system.

At non-towered airports, pilots “see-and-avoid” other aircraft in the local area aided through the use of a series of position reports using the Common Traffic Advisory Frequency (CTAF). This frequency also can be used to select the intensity of the runway and approach lighting using the pilot controlled lighting system. The CTAF for Black Hills Airport - Clyde Ice Field is 122.7 which is also used for the pilot controlled lighting.

At non-towered airports, pilot’s open and close FAA flight plans on the ground through phone or internet, or through ARTCC or Flight Service Station (FSS) in the air. FSS provides various services including flight plan opening/cancelling, timely en-route weather information, Notices to Airmen (NOTAM), and Air Traffic Control advisories. A Remote Communications Outlet (RCO) provides a reliable link allowing aircraft to directly contact the FSS.

Black Hills Airport - Clyde Ice Field has a Ground Control Outlet at 121.725 to contact Ellsworth Approach with 4 clicks and Denver ARTCC with 6 clicks. In the air Ellsworth may be contacted at 119.5 from 0500 to 0000 Z and Denver ARTCC can be contacted at 127.95.

Recommendations

It is recommended to maintain the existing Communication Aids.

Table K-1 - NAVAID Summary

NAVAID Summary				
Type	Standard	Existing	Future	Ultimate
Area Navigation	GPS, NDB	GPS, NDB	GPS	GPS
Meteorological	ASOS/AWOS	AWOS-III	AWOS-III	AWOS-III
Communication	CTAF, GCO	CTAF, GCO	CTAF, GCO	CTAF, GCO
Runway Approach	PAPI (13-31)	PAPI (13-31)	PAPI (13-31 & 5-23)	PAPI (13-31 & 5-23)
Visual Airfield	MIRL, Non-Precision	MIRL, Non-Precision	MIRL, Non-Precision	MIRL, Non-Precision

Source: FAA 5010 Form

Note: Runway/end identified in parenthesis