Airborne Position Reference Tool (APRT) Minimum Requirements for Non-federal Applications

Version 0.1
December 2024

CONTENTS

1 INTRODUCTION

1.1 SCOPE

This document contains the minimum functional and performance requirements for Airborne Position Reference Tools (APRT) systems/services (previously referred to as Situational Awareness Displays). The minimum functional and performance requirements apply to all Non-federal APRT systems used in providing Airport Traffic Control Tower (ATCT) services in Class D airspace. The APRT concept of operation is defined in the Federal Aviation Administration (FAA) *Situational Awareness (SA) Display System Concept of Operations*.

1.1.1 DOCUMENT LAYOUT

Section 1.2 provides a high-level APRT system overview.

Section 2 contains the system, functional, and performance requirements. The system and functional requirements are functions that the intended solution needs to perform to satisfy the mission of the APRT system. The performance requirements assert how well the functional requirement needs to perform to satisfy the mission of the APRT system.

Section 3 contains the APRT system Physical Integration requirements and Human Factors considerations.

Section 4 contains the Safety and Reliability, Maintainability, and Availability (RMA) considerations.

Section 5 contains the Information Systems Security requirements.

1.1.2 DOCUMENT CONVENTIONS

The requirements for APRT systems contained in this document utilizes the following conventions:

 a. **Must** – This is a mandatory requirement (e.g., The APRT system must display airborne targets only).
 b. **Should** – This is a recommendation. The function "should" perform in this manner (e.g., The APRT map should include range rings).

All of the requirements in this document are tagged with a unique requirement identifier as [Rxxx] or [Nxxx].

> where "xxx" is a unique numerical value
> "R" identifies minimum requirements (must) and
> "N" identifies a recommendation (should)

Unique requirement identifiers are not necessarily in numerical order within the requirement document but are subject to change with the final version.

In the event of a conflict between referenced documents and the contents of this specification, the contents of this specification take precedence.

1.2 SYSTEM OVERVIEW

The APRT system is composed of the following list of functions: Target Data, Data Processing, and Display. The functional description is not intended to imply a particular architecture. The following subsections define the genericized functions that each APRT system is expected to provide.

Figure 1 - Functional Block Diagram

The following functions have been identified as the functionality to be expected from an applicant's APRT system. Optional outputs identified in Appendix A were considered in preparation of these requirements, where minimum requirements have been identified for these outputs. If an applicant proposes the use of an APRT system that incorporates features or capabilities beyond those identified in this document, the FAA will require the applicant to provide a system-specific safety assessment to enable those capabilities.

a. **Target Data** –This function is the source of capturing target information. It consists of the source of target data, provided by either a sensor (e.g. Automatic Dependent Surveillance-Broadcast (ADS-B) receiver), or data received via the internet from a service provider. At a minimum, the lateral target position is a required output. Optionally, an applicant's design may provide target IDs or data tags as outputs from this function. The target ID serves as a unique identifier for the Data Processing function if multiple data sources are used. A data tag is a graphic overlay associated with a target that displays additional information such as aircraft type, speed, altitude, heading, tail number, call sign, and flight number.

b. **Data Processing** – This function processes target data and combines or formats the data as appropriate to ensure that the same target doesn't appear multiple times, which is particularly important when multiple data sources are being employed. Implementation will depend on the system configuration and may be divided between multiple processing platforms. At a minimum, the lateral target position is a required output. Optionally, an applicant's design may provide data tags as an output from this function.

c. **Display** –This function is responsible for rendering the display for use by ATC personnel. The airborne targets must be projected on a map of the airport environment. The airport environment map is resident within this function. Optionally, an applicant's design may provide data tags, map overlays, and/or aircraft tracks as outputs from this function. Map overlays are objects depicted on the map of the airport environment, such as local obstructions/elevations, landmarks/reporting points, approach overlays, range rings, and traffic patterns. Aircraft tracks provide historical and/or projected flight trajectories. The display function may optionally incorporate controls or configuration.

2   SYSTEM, FUNCTIONAL, AND PERFORMANCE REQUIREMENTS

2.1   SYSTEM REQUIREMENTS

The APRT system must [R001] have two System States: ON and OFF. A System State of OFF means no system functionality is active. A System State of ON means at least some system functionality is active.

The APRT system should [N002] have the following system modes:

- Online: indicates that the system is fully functioning
- Degraded: indicates that the system is functional, but a fault has been detected
- Offline: indicates that the system is not available for operational use

The APRT system must [R003] provide an indication of the System State and System Mode (if applicable) to ATCS.

The APRT system must [R004] include a means to confirm proper configuration of hardware, software, and site-specific files.

2.2   FUNCTIONAL AND PERFORMANCE REQUIREMENTS

The APRT system must [R005] display airborne targets only.

The applicant must [R006] provide an analysis that assesses the risk of duplicate targets.

The APRT system must [R007] detect and display individual targets (those the system is capable of tracking) within a minimum coverage volume of 5 nautical miles (NM) from the airport reference point and at least 3,500ft above ground level (AGL).

Note: See Appendix B for additional information.

Note: An ADS-B only system is not required to detect aircraft not equipped with ADS-B.

The applicant's coverage volume should [N008] be configurable.

Note: Applicants may choose to expand their coverage volume outside of the minimum coverage volume.

The APRT system must [R009] only display targets that are within the applicant's coverage volume.

The APRT system must [R010] detect individual targets within the applicant's coverage volume with a probability greater than or equal to 95 percent per update.

Targets within the applicant's coverage volume must [R011] be displayed with a lateral accuracy better than or equal to 0.5NM.

Note – The total lateral error needs to consider sensor accuracy, update rate, latency, map display accuracy, and impact of fusion algorithms.

The APRT map should [N012] use the airport reference point as the center of the display.

The APRT map must [R013] include the runway(s) and heliport(s) as static (i.e., not removable) markers.

The APRT map overlays should [N014] include obstructions (e.g., radio towers), landmarks, and charted VFR reporting points (See *Appendix A – Function Assessment* for additional information).

The APRT system should [N015] allow users to add reference points to the APRT map.

The APRT map should [N016] include range rings.

The APRT outputs must [R017] be implemented in a manner that does not obscure targets and associated data tag(s) (See *Appendix A – Function Assessment* for additional information regarding optional outputs).

The APRT map should [N018] allow static markers to be dimmable.

The APRT system should [N019] allow the operator the capability of removing all optional display types simultaneously.

The APRT system must [R020] provide user controls for brightness.

The lateral positions of all required and optional outputs must [R021] be displayed with respect to a common coordinate frame and scale.

3   INTEGRATION REQUIREMENTS

The APRT system must [R022] not connect to any FAA networks.

The APRT system must [R023] be designed to operate in the intended usage environment (e.g., indoor controlled and outdoor uncontrolled).

The APRT system earth grounding, AC power ground, bonding, shielding, and transient protection at the facility interface must [R024] meet the requirements specified by the NFPA 70®, National Electrical Code (NEC)® (Quincy: National Fire Protection Association).

The APRT equipment must [R025] be compatible with facility power quality requirements specified by the NEC.

The APRT system equipment must [R026] meet the electromagnetic emissions requirements specified in 47 CFR Part 15 Radio Frequency Devices.

3.1 HUMAN FACTORS

FAA HF-STD-001 Human Factors Design Standard provides applicable guidance for addressing human factors requirements related to display monitors. The following provides guidance and recommendations for the design of the APRT.

The design of the controls and displays should [N027] be consistent with FAA HF-STD-001 Human Factors Design Standard §§ 5.6, 5.7.

The design of the APRT system controls should [N028] provide consistent and predictable outcomes in relation to ATCS inputs. [FAA HF-STD-001 Human Factors Design Standard §§ 5.4.1.1.2.1, 5.2.10.17, 5.4.3.1.3, 5.4.3.1.4, 5.4.1.3.5, 5.4.3.1.6, 5.4.3.3.11]

4 SAFETY AND RELIABILITY, MAINTAINABILITY, AND AVAILABILITY (RMA) REQUIREMENTS

The APRT system should [N029] have a minimum Mean Time Between Critical Failures (MTBCF) of 2,190 hours.

5 INFORMATION SYSTEMS SECURITY REQUIREMENTS

TBD – Working with ACG to select requirements for APRTs.

APPENDICES

APPENDIX A – FUNCTIONAL ASSESSMENT

FUNCTION	REQUIRED OUTPUT	OPTIONAL OUTPUT	KEY CHARACTERISTICS
Target Data	Lateral Target Position (Individual Aircraft)	Target ID[1] Data Tag[2]	Accuracy
			Latency
			Completeness
			Update Rate
Data Processing	Lateral Target Position (Fused)	Data Tag[2]	Accuracy
			Latency
			Completeness
			Update Rate
Display	Map of the Airport Environment Lateral Target Position	Data Tag[2,3] Map Overlay[4] Aircraft Track[5]	Accuracy
			Latency
			Completeness
			Update Rate
			Display Range[3]

1. Target ID may be required if multiple data sources are used to avoid showing multiple targets for a single aircraft (i.e., unique identifier).
2. Data Tag may include any or all of the following but are not limited to: Aircraft Type, Speed, Altitude, Heading, Tail Number, Call Sign, Flight Number, etc.
3. The display of these items may be adjustable via user controls.
4. Local obstructions/elevations, landmarks/reporting points, approach overlays, traffic pattern.
5. Aircraft track may include history as well as projected flight trajectories.

APPENDIX B – APPLICANT COVERAGE VOLUME

The intent of the following figure is to provide clarity between the terms:

- Minimum Coverage Volume
- Applicant's Coverage Volume
- Configurable Coverage Volume

The "minimum coverage volume" identified by the inner region of the figure is defined by requirement [R007]. All airborne targets (note that [R005] excludes ground targets) within the "minimum coverage volume" are required to be displayed.

An applicant is expected to define their "applicant coverage volume", which is required to encompass the "minimum coverage volume" and is represented by the outer region in the figure. Multiple requirements are imposed on the "applicant coverage volume" including display of all targets [R009], meet display probability of 95% [R010] and meeting 0.5NM accuracy [R011].

The applicant is recommended to have a "configurable service volume" [N008] as depicted by the dotted line region in the Figure. All "applicant coverage volume" requirements apply to the "configurable service volume" when the configured service volume is used.
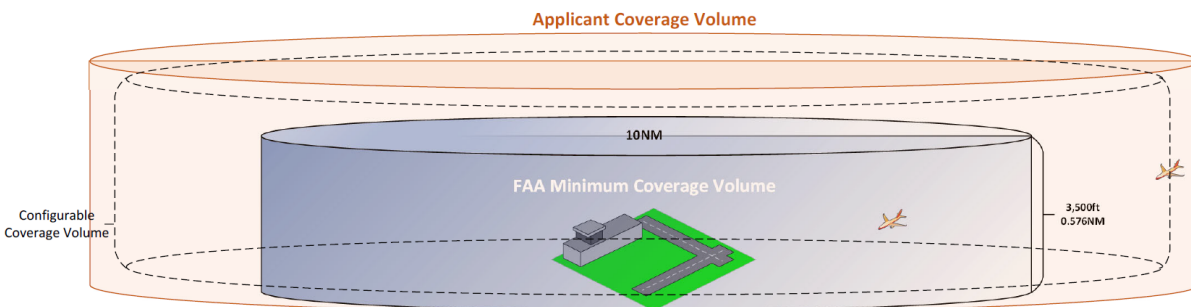

Figure 2 - Applicant Coverage Volume

APPENDIX C - ACRONYMS

APPENDIX D – REFERENCE DOCUMENTS

The following documents are referenced and/or applicable to this document. Unless specifically noted, the latest revision of the document applies.

Federal Aviation Administration (FAA), Office of NextGen, William J. Hughes Technical Center. *Human Factors Design Standard*. (HF-STD-001)

Telecommunication – Radio Frequency Devices, 47 CFR § 15

Federal Aviation Administration (FAA), Advanced Systems Design Service Team. Situational Awareness (SA) Display System Concept of Operations.

NFPA 70®, National Electrical Code (NEC)® (Quincy: National Fire Protection Association).