**FAA**

NextGen Portfolio Management & Technology Development Directorate (ANG-C)

# Remote Tower System Pilot Program

## *Operational Visual Requirements*

*Version No. 2.1*

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# Document Revision History

| Version | Date | Author | Sections Changed | Description of Change |
|---|---|---|---|---|
| **1.0** | 7/5/2019 | ANG-C5 | All | Initial draft |
| **1.1** | 8/13/2020 | ANG-C5 | Section 2 | Expanded methodology section |
| **2.0** | 11/21/2022 | ANG-C5 | All | Updated based on lessons learned |
| **2.1** | 1/10/2023 | ANG-C5 | Section 4, Appendix A | Replaced “landing threshold” with “runway threshold” |

# Acronyms

| Acronym | Definition |
|---|---|
| **AIM** | Aeronautical Information Manual |
| **AJI** | Safety and Technical Training |
| **AJT** | Terminal Service, Air Traffic Organization |
| **AJV** | Mission Support Services |
| **AJW** | Technical Operation Services, Air Traffic Organization |
| **ANG** | Office of NextGen |
| **AOV** | Air Traffic Safety Oversight Service |
| **APO** | Office of Aviation Policy and Plans |
| **ATC** | Air Traffic Control |
| **ATCT** | Airport Traffic Control Tower |
| **ATO** | Air Traffic Organization |
| **FAA** | Federal Aviation Administration |
| **FCT** | Federal Contract Tower |
| **JO** | Joint Order |
| **MEL** | Minimum Equipment List |
| **NAS** | National Airspace System |
| **NATCA** | National Air Traffic Controllers Association |
| **nm** | Nautical Miles |
| **OVD** | Operational Viability Decision |
| **OVR** | Operational Visual Requirement |
| **PCG** | Pilot Controller Glossary |
| **QVSL** | Qualified Vendor System List |
| **RT** | Remote Tower |
| **SDA** | System Design Approval |
| **SME** | Subject Matter Expert |
| **SRMD** | Safety Risk Management Document |
| **VMC** | Visual Meteorological Conditions |

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# 1 Purpose and Scope

The Remote Tower (RT) System Operational Visual Requirements (OVRs) described in this document identify the visual informational needs of controllers at Airport Traffic Control Towers (ATCTs) providing Class D operational air traffic services. These requirements are scoped to the visual and operational needs of controllers. Technical requirements and equipment standards are not within the scope of the OVRs. These RT System OVRs are the basis for the Federal Aviation Administration (FAA) Air Traffic Organization (ATO) Operational Viability decision for RT systems.

The RT System OVRs Document is a living document that will continue to be updated, improved, and validated with testing new RT systems and airport configurations. This Version 2.0 builds upon Version 1.0 of the OVRs and incorporates lessons learned at the RT system sites to date (specifically updating OVRs to be observed from a single reference point, updating detection distances, and adding a third display definition). The focus of RT System OVRs is on the visual information needs of controllers in an ATCT in Class D airspace. The following assumptions were made for the RT System OVRs with future updates potentially addressing these assumptions as RT capabilities expand:

- Visual Meteorological Conditions (VMC)
- RT system operated without additional surveillance information provided (e.g., RADAR)
- ATCT is equipped with Federal Contract Tower (FCT) Minimum Equipment List (MEL) in place (FAA Order Joint Order (JO) 7210.78, *FAA Contract Tower (FCT) New Start and Replacement Tower Process*)
- Manual weather observations are excluded but will be taken in accordance with FAA JO 7210.77, *Non-Federal Weather Observation Program* and FAA JO 7900.5, *Surface Weather Observing*

In an ATCT, visual information may not always be available or may be reduced by prevailing conditions (e.g., at night, during low visibility weather conditions, or visibility obstruction conditions, such as thick smoke or ash). The fact that visual information is not always available or is sometimes reduced moment by moment is the case in traditional towers as well and often depends on such prevailing conditions and other factors (e.g., size, color, design of aircraft; direction of flight, etc.). The OVRs are not intended to imply that all of the visual information detailed in each requirement will be available to controllers consistently, rather in ideal conditions each OVR would be met. Therefore, RT systems are not expected to meet every OVR at all times, as condition variability, controller workload, and duty prioritization will affect whether a specific OVR is met at any given moment. Additionally, controllers obtain information from a variety of sources (e.g., pilot reports). The OVRs are not intended to imply visual information from the RT visual presentation is always the sole source of information for controllers in all conditions.

The OVRs are just one aspect of the evaluation to determine if an RT system is capable and feasible for use in the National Airspace System (NAS; Figure 1). The OVRs will be used to inform the Air Traffic Operational Viability Decision (OVD); in other words, they are meant to inform the approval of an RT system from an air traffic perspective, in particular approval from Terminal Service, Air Traffic Organization (AJT). The OVRs are the metrics used to determine whether all ATCT services can be provided using an RT system and to ensure RT systems provide the necessary visual information for those services. Additional minimum functional, performance, safety, and security requirements are being developed as the basis for the System Design Approval (SDA). Concurrently, a Cost-Benefit model has been developed, led by the Office of Aviation Policy and Plans (APO), to determine the feasibility of using an RT system from a cost perspective.

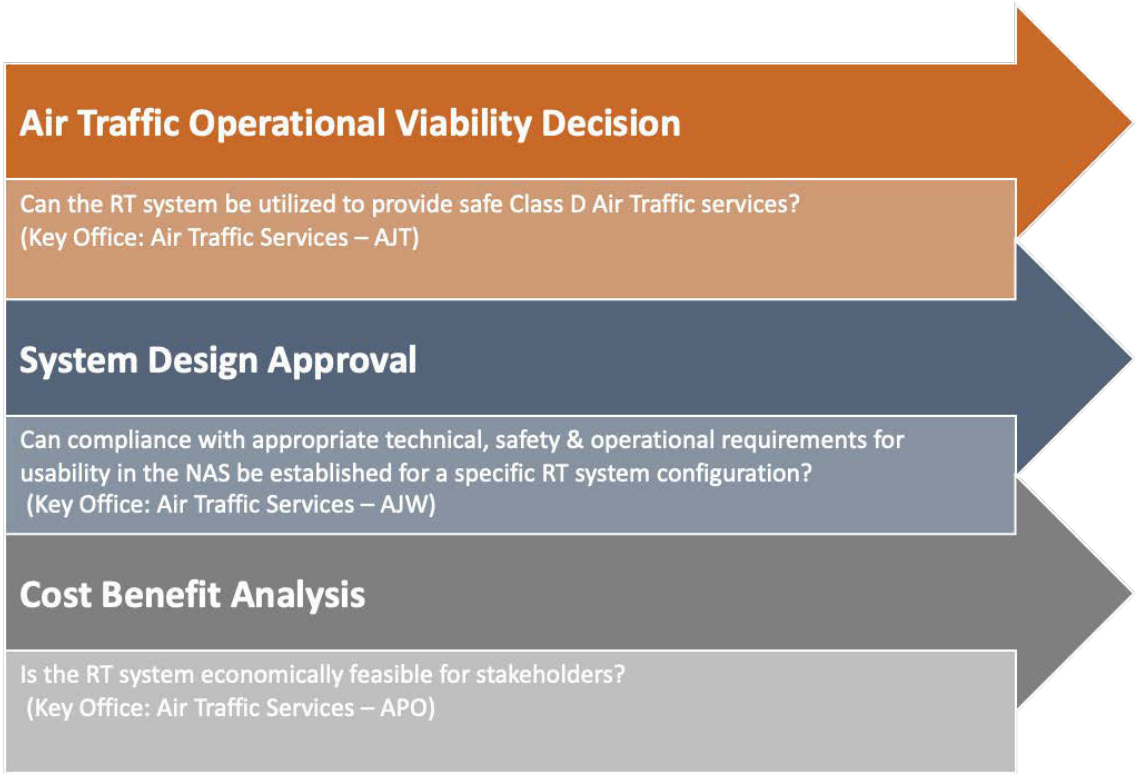


Figure 1: RT Feasibility Methodology

Note: Once an RT system is determined to be Operationally Viable and meets the hardware/software requirements, it will achieve SDA, be commissioned, and be added to an RT Qualified Vendor System List (QVSL).

This document details the methodologies utilized in finalizing Version 2.0 of the OVRs. For more information on the earlier versions of the OVRs and the methodologies associated, please review Version 1.1 of this document. The OVR methodology is reviewed in more detail in the following sections.

# 2 Process

Initial draft OVRs were developed using a variety of different information sources including, but not limited to, RT system site-specific evaluations and results, RT system site-specific safety risk management documents (SRMDs), FAA Orders, Title 14 of the Code of Federal Regulations Part 91, and FAA research findings (e.g., FAA ATCT Job Analysis, operational evaluations, etc.). A series of workshops during 2018 and 2019 with FAA Air Traffic Control (ATC) subject matter experts (SMEs) from AJT, Mission Support Services (AJV), Safety and Technical Training (AJI), Air Traffic Safety Oversight Service (AOV), Office of NextGen (ANG), and National Air Traffic Controllers Association (NATCA) were conducted to develop Version 1.0 of the OVRs. The workshops resulted in 91 OVRs (Version 1.0). These OVRs, along with a process document, were distributed to ATO, ANG, and NATCA stakeholders who participated in the workshops for comment. Members from ANG, NATCA, and ATO provided feedback on the document. Comments were adjudicated and addressed by the workshop facilitators from the ANG team. Version 1.0 OVRs were solidified on July 5, 2019.

It was determined that the OVRs should continue to be revisited and updated based on lessons learned from RT evaluations. Version 1.0 of the OVRs had minimal evaluation data to inform OVR development. However, the evaluation team now has more data and experience evaluating RT systems with different conceptual designs (e.g., single-mast vs. multi-mast systems) that operate in differing airport environments (e.g., different runway lengths). To address this gained knowledge, workshops to discuss OVR updates based on lessons learned from two pilot program site evaluations were held starting in August 2022. These workshops resulted in Version 2.0 of the OVRs. Discussions mainly revolved around changing from “active runway surface area” to a single reference point in detection and spatial relationship OVRs, updating “primary” / “secondary” display definitions and adding a third display term, and OVR assignment to each display type. Redundant OVRs were also discussed and removed from the list. One new OVR was added resulting in 89 OVRs. Version 2.0 of the OVRs is in Section 4, Table 1. Specific details and justifications for the updates are in Appendix A.

# 3 OVR Definitions and Key Terms

The RT System OVRs include 89 operational requirement statements and can be viewed as a summary in Section 4, Table 1, and in detail in the accompanying file.

## 3.1 Visual Information Component

Each of the RT System OVRs describes the controllers' visual information need(s) as defined below:

- **Detect**: Refers to the user's ability to notice the presence of a particular object (Ellis & Liston, 2011)
- **Recognize**: Refers to the user's ability to categorize the object into a general class (e.g., high-wing or low-wing aircraft) (Ellis & Liston, 2011)
- **Identify**: Refers to the user's ability to determine the specific type of object (Ellis & Liston, 2011)
- **Verify**: Refers to the user's ability to corroborate visual information with known external information (e.g., pilot report)
- **Observe**: Refers to the user's ability to discern an object's state and any changes in an object's state in the context of the environment. An object's state includes altitude, orientation, speed, attitude, position, and/or condition.

## 3.2 Primary/Secondary/Tertiary Display

The RT System OVRs must be met by the controller utilizing one of three modes:

- Primary display
- Secondary display or primary display
- Tertiary display or secondary display or primary display

Primary, secondary, and tertiary displays are defined as follows:

- **Primary Display**: Fixed, continuous 360-degree view of the airfield and surrounding airspace.
- **Secondary Display**: Fixed, partial view(s) of the airfield and/or surrounding airspace for the active runway(s). The secondary display for the active runway(s) must be presented to the user at all times. If used, the secondary display must be utilized in addition to the primary display.
- **Tertiary Display**: Directional and aim-able partial view(s) of the airfield and/or surrounding airspace. The tertiary display may or may not always be presented to the user. If used, tertiary displays must be utilized in addition to the primary display or secondary display.

A display, as defined for an RT System, can consist of a screen(s) or window(s) depicting a continuous view to the user. Spatial relationships must only be observed and determined from the same field of view depicted on the same classification of display (primary, secondary, or tertiary). In this case, singular or multiple cameras may be utilized for the same field of view if views are displayed in a continuous manner (e.g., multiple cameras to comprise the primary display). Examples include:

- A controller can use the primary display to observe the spatial relationship between two aircraft in the pattern.
- A controller can observe the spatial relationship between two aircraft in the run-up area utilizing the secondary display of the run-up area.

If both aircraft are not in the field of view of the same secondary display (e.g., one aircraft on a secondary display and another aircraft on the primary display), then the primary display must be used to observe their spatial relationship.

## 3.3 Category Aircraft

Some OVRs refer to specific categories of aircraft. Same runway separation aircraft categories are defined in FAAO JO 7360.1, Aircraft Type Designators, and FAAO JO 7110.65, Section 3-9-6, Same Runway Separation, as follows:

- Category 1: Small single-engine propeller-driven aircraft weighing 12,500 lbs. or less, and all helicopters.
- Category 2: Small twin-engine propeller-driven aircraft weighing 12,500lbs or less.
- Category 3: All other aircraft.

The workgroup provided examples of aircraft size as related to the requirements for observation of aircraft on the final approach. When referencing sizes of aircraft for these requirements, the following example aircraft may be referenced:

- Category 1: Cessna 172
- Category 2/Category 3 Small: Piper Cheyenne, Cessna Citation
- Category 3 (excluding Category 3 Small): Boeing 737, Gulfstream 5

## 3.4 Separation Information

If applicable, the OVR was linked to the visual information needed to provide separation in one of the following categories:

- Standard Runway Separation
- Reduced Same Runway Separation
- Intersecting Runway / Intersecting Flight Path Separation
- IFR Separation
- Wake Turbulence Separation

## 3.5 Airport Traffic Pattern

The standard traffic pattern applies to all OVRs that reference the traffic pattern or portion of the traffic pattern. Per FAA-H-8083-3B, Airplane Flying Handbook, Chapter 7:

> *"Airport traffic patterns are developed to ensure that air traffic is flown into and out of an airport safely. Each airport traffic pattern is established based on the local conditions, including the direction and placement of the pattern, the altitude at which it is to be flown, and the procedures for entering and exiting the pattern. It is imperative that pilots are taught correct traffic pattern procedures and exercise constant vigilance in the vicinity of airports when entering and exiting the traffic pattern. Information regarding the procedures for a specific airport can be found in the Chart Supplements. Additional information on airport operations and traffic patterns can be found in the Aeronautical Information Manual (AIM)."*

## 3.6 Site-Specific Areas

Site-specific areas refer to any area on the airport surface that may need additional and/or specific requirements for the controller to complete visual tasks (e.g., hotspots, blind spots).

## 3.7 Other Definitions

- **Active Runway Surface Area**: "Any runway or runways currently being used for takeoff or landing." (7110.65 PCG)
- **Area of Jurisdiction**: An ATCT's airspace or area of responsibility.
- **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." (7110.65 PCG) Runway OVRs supersede movement area OVRs.
- **Physical Landmarks**: A material object on the airport surface or vicinity nearby. Physical landmarks may not be substituted with virtual overlays within the RT System.
- **Primary Display Camera Mast**: The camera mast providing the primary display's field of view.
- **Relative Altitude**: Altitude of one object in reference to another object.
- **Relative Position**: The location of one object in reference to another object.
- **Relative Speed**: Refers to slowing down, speeding up, and relative speed to other objects.

# 4 Remote Tower System Operational Visual Requirements (Version 2.0)

Table 1: RT System OVR (Version 2.0)

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V001** | The remote tower system must permit the controller to visually recognize an aircraft on the runway. | X | | | 3-1-3.; 3-1-7.; 3-9-4.; 3-9-5.; 3-9-6.; 3-9-10.; 3-10-3.; 3-10-6.; 3-10-9.; 3-10-10.; |
| **V002** | The remote tower system must permit the controller to visually identify an aircraft on the runway. | | | X | 3-9-6.; 3-10-3. |
| **V003** | The remote tower system must permit the controller to visually recognize an aircraft on the runway safety area. | X | | | 3-1-3.; 3-1-7.; 3-10-9.; |
| **V004** | The remote tower system must permit the controller to visually identify an aircraft on the runway safety area. | | | X | 3-9-5.; 3-9-6.; 3-10-3.; 3-10-9.; |
| **V005** | The remote tower system must permit the controller to visually recognize an aircraft on the movement area. | | X | | 3-1-3.; 3-1-6.: 3-1-7.; 3-7-1.; 3-7-2.; 3-9-5.; 3-10-9.; |
| **V006** | The remote tower system must permit the controller to visually identify an aircraft on the movement area. | | | X | 3-1-6.: 3-1-7.; |
| **V007** | The remote tower system must permit the controller to visually recognize an aircraft operating within any site-specific area. | | X | | 3-1-3.; 3-1-7.; |
| **V008** | The remote tower system must permit the controller to visually identify an aircraft operating within any site-specific area. | | | X | 3-1-6.: 3-1-7.; |
| **V009** | The remote tower system must permit the controller to visually observe an aircraft's direction of movement on the runway. | X | | | 3-1-3.; 3-9-5.; 3-10-6.; 3-10-9.; 3-10-10.; |
| **V010** | The remote tower system must permit the controller to visually observe an aircraft's direction of movement on the runway safety area. | X | | | 3-1-3.; 3-9-5.; 3-10-9.; |
| **V011** | The remote tower system must permit the controller to visually observe an aircraft's direction of movement on the movement area. | X | | | 3-1-3.; 3-9-5.; 3-10-6.; 3-10-9.; |
| **V012** | The remote tower system must permit the controller to visually observe an aircraft's direction of movement on any site-specific area. | X | | | 3-1-3.; 3-1-7.; |
| **V013** | The remote tower system must permit the controller to visually observe an aircraft's relative speed on the runway. | X | | | 3-1-3.; 3-9-5.; 3-10--6.; 3-10-9.; |
| **V014** | The remote tower system must permit the controller to visually observe an aircraft's relative speed on the runway safety area. | X | | | 3-1-3.; 3-9-5.; 3-10-6.; 3-10-9.; |

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V015** | The remote tower system must permit the controller to visually observe an aircraft's relative speed on the movement area. | X | | | 3-1-3.; 3-9-5.; 3-10-6.; 3-10-9.; |
| **V016** | The remote tower system must permit the controller to visually observe an aircraft's relative speed on any site-specific area. | X | | | 3-1-3.; 3-1-7.; |
| **V017** | The remote tower system must permit the controller to visually observe the aircraft's spatial relationship with other aircraft on the runway. | X | | | 3-1-3.; |
| **V018** | The remote tower system must permit the controller to visually observe aircraft's landing roll. | X | | | 3-1-3.; 3-10-6.; 3-10-9.; |
| **V020** | The remote tower system must permit the controller to visually observe the aircraft's spatial relationship with the runway holding position markings. | X | | | 3-1-3.; 3-9-5.; 3-9-10.; 3-10-3.; 3-10-9.; |
| **V021** | The remote tower system must permit the controller to visually observe the arrival aircraft's spatial relationship with the runway threshold | X | | | 3-8-1.; 3-10-3.; 3-10-6.; |
| **V022** | The remote tower system must permit the controller to visually observe the aircraft's spatial relationship with the departure end of the runway. | X | | | 3-8-1.; 3-9-6.; 3-9-9.; 3-10-3.; |
| **V023** | The remote tower system must permit the controller to visually observe when a departure aircraft is airborne. | X | | | 3-9-6.; 3-10-3.; |
| **V025** | The remote tower system must permit the controller to visually observe the start of an aircraft's takeoff roll. | X | | | 3-1-3.; 3-9-5.; |
| **V026** | The remote tower system must permit the controller to visually observe an aircraft's initial departure turn over the runway. | X | | | 3-8-1.; 3-9-6; 3-9-8.; 3-9-9.; |
| **V027** | The remote tower system must permit the controller to visually verify that the runway is free of all known objects the size of a deer or larger. | | | X | 3-1-3.; 3-1-5.; 3-9-6.; 3-10-3.; |
| **V028** | The remote tower system must permit the controller to visually observe the location of an aircraft on the runway in reference to intersections. | X | | | 3-1-3.; 3-9-7; 3-9-8; 3-9-10.; 3-10-4.; 3-10-9.; |
| **V029** | The remote tower system must permit the controller to visually observe the location of an aircraft on the runway in reference to suitable landmarks. | X | | | 3-1-3.; 3-9-5.; 3-9-6; 3-10-3.; 3-10-6.; |

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V030** | The Remote Tower System must permit the controller to visually verify if a known arrival aircraft is Category 1 at 1 nautical mile from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; 3-10-11.; |
| **V031** | The remote tower system must permit the controller to visually observe a Category 1 arrival aircraft's direction of flight at 1 nautical mile from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V032** | The remote tower system must permit the controller to visually observe a Category 1 arrival aircraft's relative speed at 1 nautical mile from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V033** | The remote tower system must permit the controller to visually observe a Category 1 arrival aircraft's relative altitude at 1 nautical mile from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V034** | The remote tower system must permit the controller to visually verify if a known arrival aircraft is Category 2 at 1.5 nautical miles from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V035** | The remote tower system must permit the controller to visually observe a Category 2/Category 3 Small arrival aircraft's direction of flight at 1.5 nautical miles from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V036** | The remote tower system must permit the controller to visually observe a Category 2/Category 3 Small arrival aircraft's relative speed at 1.5 nautical miles from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V037** | The remote tower system must permit the controller to visually observe a Category 2/Category 3 Small arrival aircraft's relative altitude at 1.5 nautical miles from the runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V038** | The remote tower system must permit the controller to visually verify if known an arrival aircraft is Category 3/Large at 2 nautical miles from runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V039** | The remote tower system must permit the controller to visually observe a Category 3 (excluding Category 3 Small) arrival aircraft's direction of flight at 2 nautical miles from runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V040** | The remote tower system must permit the controller to visually observe a Category 3 (excluding Category 3 Small) arrival aircraft's relative speed at 2 nautical miles from runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V041** | The remote tower system must permit the controller to visually observe a Category 3 (excluding Category 3 Small) arrival aircraft's relative altitude at 2 nautical miles from runway threshold. | | X | | 3-8-1.; 3-9-6; 3-10-6.; |
| **V042** | The remote tower system must permit the controller to visually observe a departing aircraft passing through any intersecting flight path. | X | | | 3-9-7.; 3-9-9.; 3-10-4.; |
| **V043** | The remote tower system must permit the controller to visually observe a departing aircraft passing through any runway intersection. | X | | | 3-9-7.; 3-9-8.; 3-10-4.; |
| **V044** | The remote tower system must permit the controller to visually observe an arriving aircraft passing through the projected intersecting flight path of another aircraft. | X | | | 3-9-8.; 3-10-4.; |
| **V045** | The remote tower system must permit the controller to visually observe an arriving aircraft will hold short of any runway intersection. | X | | | 3-1-3.; 3-9-7.; 3-9-8.; 3-10-4.; |
| **V046** | The remote tower system must permit the controller to visually observe the spatial relationship between taxiing or hover-taxi helicopters and other aircraft. | X | | | 3-7-3.; 3-10-9.; 3-11-1.; |
| **V047** | The remote tower system must permit the controller to visually detect aircraft at a minimum of 3.0 nautical miles laterally from the primary display camera mast and at a minimum of the area of jurisdiction's altitude for a percentage of detection observations of 50% or more. | X | | | 3-8-1.; 2-1-21.; |
| **V048** | The remote tower system must permit the controller to visually observe an aircraft in reference to suitable physical landmarks for 3,000 feet same runway separation in accordance with JO 7110.65 3-9-6 and 3-10-3. | X | | | 3-9-6.; |
| **V049** | The remote tower system must permit the controller to visually observe an aircraft in reference to suitable physical landmarks for 4,500 feet same runway separation in accordance with JO 7110.65 3-9-6 and 3-10-3. | X | | | 3-9-6.; |
| **V050** | The remote tower system must permit the controller to visually observe an aircraft in reference to suitable physical landmarks for 6,000 feet same runway separation in accordance with JO 7110.65 3-9-6 and 3-10-3. | X | | | 3-9-6.; |

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V052** | The remote tower system must permit the controller to visually observe an aircraft abort takeoff. | X | | | 3-1-3.; |
| **V053** | The remote tower system must permit the controller to visually observe an aircraft execute a go-around. | X | | | 3-8-1.; 3-10-2.; |
| **V054** | The remote tower system must permit the controller to visually observe with reference to suitable surface markings a helicopter is a minimum of 200 feet from a simultaneous departing helicopter. | X | | | 3-11-5.; |
| **V055** | The remote tower system must permit the controller to visually observe with reference to suitable surface markings a helicopter is a minimum of 200 feet from a simultaneous landing helicopter. | X | | | 3-11-5.; |
| **V056** | The remote tower system must permit the controller to visually recognize a vehicle on the runway. | X | | | 3-1-3.; 3-1-5.; 3-1-6.; 3-9-5.; 3-10-10.; |
| **V057** | The remote tower system must permit the controller to visually recognize a vehicle on the runway safety area. | X | | | 3-1-3.; 3-1-7.; 3-7-5.; 3-7-6.; 3-10-9.; |
| **V058** | The remote tower system must permit the controller to visually recognize a vehicle on the movement area. | | X | | 3-1-6.; 3-3-3.; 3-7-1.; 3-7-2.; 3-10-9.; |
| **V059** | The remote tower system must permit the controller to visually recognize a vehicle on any site-specific areas. | | X | | 3-1-6.; 3-3-3.; 3-7-1.; 3-7-2.; 3-10-9.; |
| **V060** | The remote tower system must permit the controller to visually detect a pedestrian on the runway. | | | X | 3-1-3.; 3-1-5.; 3-1-6.; 3-3-3.; 3-10-10.; |
| **V061** | The remote tower system must permit the controller to visually detect a pedestrian on the runway safety area. | | | X | 3-1-3.; 3-1-5.; 3-1-6.; 3-3-3.; |
| **V062** | The remote tower system must permit the controller to visually detect a pedestrian on the movement area. | | | X | 3-1-5.; 3-1-6.; 3-3-3.; |
| **V063** | The remote tower system must permit the controller to visually observe a vehicle’s direction of movement when operating on the movement area. | | X | | 3-1-3.; |
| **V064** | The remote tower system must permit the controller to visually observe a vehicle’s relative speed on the movement area. | | X | | 3-1-3.; |
| **V065** | The remote tower system must permit the controller to visually observe an aircraft's spatial relationship with other aircraft on the movement area. | | X | | 3-7-1.; 3-7-2.; |
| **V066** | The remote tower system must permit the controller to visually observe an aircraft's spatial relationship with a known object on the airport surface. | X | | | 3-1-3.;3-3-3.; |

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V067** | The remote tower system must permit the controller to visually observe an aircraft on the upwind leg of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V068** | The remote tower system must permit the controller to visually observe an aircraft turning from upwind leg to crosswind leg of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V069** | The remote tower system must permit the controller to visually observe an aircraft on the crosswind leg of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V070** | The remote tower system must permit the controller to visually observe an aircraft turning from crosswind leg to downwind leg of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V071** | The remote tower system must permit the controller to visually observe an aircraft on the downwind leg of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V072** | The remote tower system must permit the controller to visually observe an aircraft turning from downwind leg to base leg of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V073** | The remote tower system must permit the controller to visually observe an aircraft on the base leg of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V074** | The remote tower system must permit the controller to visually observe an aircraft turning from base leg to final approach of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V075** | The remote tower system must permit the controller to visually observe an aircraft on final of a standard traffic pattern. | X | | | 3-8-1.; 3-10-6.; 3-10-11.; |
| **V076** | The remote tower system must permit the controller to visually verify an aircraft's relative position to landmarks at a minimum of 3 nautical miles from the primary display camera mast. | X | | | 3-8-1.; |
| **V077** | The remote tower system must permit the controller to visually observe an aircraft's spatial relationship with other aircraft at a minimum of 3 nautical miles laterally from the primary display camera mast and at a minimum of the area of jurisdiction’s altitude. | X | | | 2-1-6.; 3-8-1.; 2-1-21.; 7-2-1.; 7-5-3.; 7-5-5.; |
| **V078** | The remote tower system must permit the controller to visually verify the status of the runway edge lights. | X | | | 3-4-10.; |
| **V079** | The remote tower system must permit the controller to visually verify the status of the taxiway lights. | | | X | 3-4-16.; |

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V080** | The remote tower system must permit the controller to visually detect construction work on the movement area. | X | | | 3-1-5.; 3-1-6.; 3-3-3.; |
| **V081** | The remote tower system must permit the controller to visually detect construction work immediately adjacent to the movement area. | | | X | 3-1-5.; 3-1-6.; 3-3-3.; |
| **V082** | The remote tower system must permit the controller to visually observe site-specific airport conditions impacting operations. | | | X | 3-3-1.; 3-3-3.; |
| **V083** | The remote tower system must permit the controller to visually observe spatial relationships between aircraft and site-specific obstructions. | | | X | 3-3-1.; 3-3-3.; |
| **V084** | The remote tower system must permit the controller to visually observe fixed-wing aircraft rock wings in response to a light gun signal between sunrise and sunset. | | | X | 3-2-3.; |
| **V085** | The remote tower system must permit the controller to visually observe fixed-wing aircraft move ailerons or rudders while on the ground in response to a light gun signal between sunrise and sunset. | | | X | 3-2-3.; |
| **V086** | The remote tower system must permit the controller to visually observe fixed-wing aircraft flash navigation or landing lights in response to a light gun signal between sunset and sunrise. | | | X | 3-2-3.; |
| **V087** | The remote tower system must permit the controller to visually observe a helicopter flash the landing light in response to a light gun signal between sunrise and sunset. | | | X | 3-2-3.; |
| **V088** | The remote tower system must permit the controller to visually observe a helicopter rock the tip path plane in response to a light gun signal between sunrise and sunset. | | | X | 3-2-3.; |
| **V089** | The remote tower system must permit the controller to visually observe a helicopter flash the landing light or search light in response to a light gun signal between sunset and sunrise. | | | X | 3-2-3.; |
| **V090** | The remote tower system must permit the controller to visually recognize visibility landmarks for tower visibility observations in accordance with JO 7110.65 2-6-3. | X | | | 2-6-3.; |

| ID | Operational Visual Requirement | Primary Display | Secondary Display | Tertiary Display | 7110.65 Link |
|---|---|---|---|---|---|
| **V091** | The remote tower system must permit the controller to visually observe an aircraft landing gear for a Category 1 aircraft at a minimum of 1/2 nautical mile from any active runway surface when requested. | | | X | 3-1-10; |
| **V092** | The remote tower system must permit the controller to visually detect a known straight-in arrival aircraft at a minimum of 3 nm from the runway threshold. | | X | | 3-8-1.; 2-1-21.; |

# 5 Appendix A: Version 2.0 Workshop Updates

Additional OVR workshops based on evaluation lessons learned were conducted in Fall 2022 and resulted in Version 2.0 of the OVRs. Workshops were led by ANG and included representatives from AJT, AJV, AJI, AJW, AOV, and NATCA. This workshop utilized a hybrid approach, where half of the participants attended in person and the other half attended virtually.

Four main topics regarding updating the OVRs were proposed and discussed:

1. Removing redundant OVRs.
2. Updating display terminology and re-evaluating which OVRs could be met on which display.
3. Updating OVRs referencing 3 nm.
4. Adding a detection OVR for known straight-in arrival aircraft.

These topics were derived from the lessons learned during onsite RT System evaluations.

## 5.1 Removal of Redundant OVRs

After reviewing all OVRs, the following OVRs were found to be redundant and were removed from the OVR list:

- V019: The remote tower system must permit the controller to visually verify the aircraft's spatial relationship with the runway holding position markings. (V020 remains)
- V024: The remote tower system must permit the controller to visually verify the start of an aircraft's takeoff roll. (V025 remains)
- V051: The remote tower system must permit the controller to visually verify an aircraft abort takeoff. (V052 remains)

The three related OVRs (V020, V025, & V052) that remain must be met on the primary display.

## 5.2 Primary, Secondary, and Tertiary Displays

“Primary display” and “secondary display” definitions were updated and a new term, “tertiary display”, was added during the workshop. The updated definitions are as follows:

- **Primary Display**: Fixed, continuous 360-degree view of the airfield and surrounding airspace.
- **Secondary Display**: Fixed, partial view(s) of the airfield and/or surrounding airspace for the active runway(s). The secondary display for the active runway(s) must be presented to the user at all times. If used, the secondary display must be utilized in addition to the primary display.
- **Tertiary Display**: Directional and aim-able partial view(s) of the airfield and/or surrounding airspace. The tertiary display may or may not always be presented to the user. If used, tertiary displays must be utilized in addition to the primary display or secondary display.

The word “fixed” was added to the primary definition to ensure each display is always presented to the controller. The word “fixed” was added to the secondary definition for the active runway(s) to ensure the active runway’s display is always presented to the controller. This ensures they can incorporate the information from the display into their normal scan pattern and a shared situational awareness. The sentence “[Secondary/Tertiary] displays must be used in conjunction with the primary display [or the secondary display]” was added to secondary and tertiary definitions to ensure the system performs as one, collaborative RT System, and not a myriad of displays that cannot be used in conjunction with each other.

After updating the display definitions, the group reviewed each OVR and confirmed that it should be met on the appropriate display. A major part of this discussion was which displays should be used for which part of the airfield/movement area. It was determined that any OVR pertaining to perceiving an object, including a pedestrian, vehicle, or aircraft on the runway needs to be met on the primary display. It was also determined by AJT that all pattern observations need to be met on the primary display.

A second discussion topic was whether spatial relationships can be determined utilizing multiple displays. For example, the question of can spatial relationships between aircraft be accurately observed and effectively utilized while using the primary display for one aircraft (e.g., an aircraft on the downwind) and the secondary display for another aircraft (e.g., an aircraft on a straight-in approach) was discussed. ATO, NATCA, and ANG representatives agreed that spatial relationships must be made from the same field of view depicted on the same display. Therefore, the following language was added to the body of this document:

> *A display, as defined for an RT System, can consist of a screen(s) or window(s) depicting a continuous view to the user. Spatial relationships must only be observed and determined from the same field of view depicted on the same classification of display (primary, secondary, or tertiary). In this case, singular or multiple cameras may be utilized for the same field of view if views are displayed in a continuous manner (e.g., multiple cameras to comprise the primary display). Examples include:*
>
> - *A controller can use the primary display to observe the spatial relationship between two aircraft in the pattern.*
> - *A controller can observe the spatial relationship between two aircraft in the run-up area utilizing the secondary display of the run-up area.*
>
> *If both aircraft are not in the field of view of the same secondary display (e.g., one aircraft on a secondary display and another aircraft on the primary display), then the primary display must be used to observe their spatial relationship.*

Declaring this statement regarding spatial relationship observations made it possible for some of the OVRs to be met utilizing the secondary display or the primary display. The following OVRs were updated to be met on the primary display:

- V025: The remote tower system must permit the controller to visually observe an aircraft's initial departure turn over the runway.
- V052: The remote tower system must permit the controller to visually observe an aircraft abort takeoff.
- V078: The remote tower system must permit the controller to visually verify the status of the runway edge lights.

The following OVRs were updated to be met on the secondary display *or* the primary display:

- V005: The remote tower system must permit the controller to visually recognize an aircraft on the movement area.
- V007: The remote tower system must permit the controller to visually recognize an aircraft operating within any site-specific area.
- V030: The Remote Tower System must permit the controller to visually verify if a known arrival aircraft is Category 1 at 1 nautical mile from the runway threshold.
- V031: The remote tower system must permit the controller to visually observe a Category 1 arrival aircraft's direction of flight at 1 nautical mile from the runway threshold.
- V032: The remote tower system must permit the controller to visually observe a Category 1 arrival aircraft's relative speed at 1 nautical mile from the runway threshold.
- V033: The remote tower system must permit the controller to visually observe a Category 1 arrival aircraft's relative altitude at 1 nautical mile from the runway threshold.
- V034: The remote tower system must permit the controller to visually verify if a known arrival aircraft is Category 2 at 1.5 nautical miles from the runway threshold.
- V035: The remote tower system must permit the controller to visually observe a Category 2/Category 3 Small arrival aircraft's direction of flight at 1.5 nautical miles from the runway threshold.

- V036: The remote tower system must permit the controller to visually observe a Category 2/Category 3 Small arrival aircraft's relative speed at 1.5 nautical miles from the runway threshold.
- V037: The remote tower system must permit the controller to visually observe a Category 2/Category 3 Small arrival aircraft's relative altitude at 1.5 nautical miles from the runway threshold.
- V038: The remote tower system must permit the controller to visually verify if a known arrival aircraft is Category 3/Large at 2 nautical miles from runway threshold.
- V039: The remote tower system must permit the controller to visually observe a Category 3 (excluding Category 3 Small) arrival aircraft's direction of flight at 2 nautical miles from runway threshold.
- V040: The remote tower system must permit the controller to visually observe a Category 3 (excluding Category 3 Small) arrival aircraft's relative speed at 2 nautical miles from runway threshold.
- V041: The remote tower system must permit the controller to visually observe a Category 3 (excluding Category 3 Small) arrival aircraft's relative altitude at 2 nautical miles from runway threshold.
- V058: The remote tower system must permit the controller to visually recognize a vehicle on the movement area.
- V059: The remote tower system must permit the controller to visually recognize a vehicle on any site-specific areas.
- V063: The remote tower system must permit the controller to visually observe a vehicle's direction of movement when operating on the movement area.
- V064: The remote tower system must permit the controller to visually observe a vehicle's relative speed on the movement area.
- V065: The remote tower system must permit the controller to visually observe an aircraft's spatial relationship with other aircraft on the movement area.

The "tertiary display" definition replaced the original "secondary display" definition. Therefore, all OVRs that were originally able to be met on the secondary display that have not been previously listed in this section were changed to the tertiary display.

## 5.3 OVRs Referencing 3 Nautical Miles

The three OVRs referencing 3 nm are listed in Table 2. The three OVRs must be met using the primary display. V047 is being updated for the reference location, percentage of observations, and altitude. V076 and V077 are being updated to coincide with V047.

Table 2: Updated 3 nm OVRs

| OVR | Version 1.0 | Version 2.0 |
|---|---|---|
| **V047** | The remote tower system must permit the controller to visually detect aircraft at a minimum of 3 nautical miles laterally and at a minimum of 1,500 feet above the top of the area of jurisdiction from active runway surface area. | The remote tower system must permit the controller to visually detect aircraft at a minimum of 3.0 nautical miles laterally from the primary display camera mast and at a minimum of the area of jurisdiction's altitude for a percentage of detection observations of 50% or more. |
| **V076** | The remote tower system must permit the controller to visually verify an aircraft's relative position to landmarks at a minimum of 3 nautical miles from active runway surface area. | The remote tower system must permit the controller to visually verify an aircraft's relative position to landmarks at a minimum of 3 nautical miles from the primary display camera mast. |

| OVR | Version 1.0 | Version 2.0 |
|---|---|---|
| **V077** | The remote tower system must permit the controller to visually observe an aircraft's spatial relationship with other aircraft at a minimum of 3 nautical miles laterally from active runway surface area and at a minimum of 1,500 feet above the top of the area of jurisdiction | The remote tower system must permit the controller to visually observe an aircraft's spatial relationship with other aircraft at a minimum of 3 nautical miles laterally from the primary display camera mast and at a minimum of the area of jurisdiction's altitude. |

### 5.3.1 Reference Location

The three OVRs in Version 1.0 utilize the "active runway surface area" for the reference location. To streamline evaluations and align with the traditional brick-and-mortar ATCT concept, the reference location in Version 2.0 is the "Primary Display Camera Mast" which is the camera mast where the 360-degree field of view is taken.

The switch to the primary display camera mast must be taken into context. The siting process outlined in FAA Orders must be adhered to. Additionally, other OVRs consider visual observations that must be made for aircraft on final, and these OVRs (V030-V041) use the runway threshold as the reference location. Other OVRs (V067 – V075) incorporate visual observations that reference a standard traffic pattern. Within the context of the siting process and the full list of OVRs, modifying these three OVRs to reference the primary display camera mast more closely matches the brick-and-mortar operations today (and the human eye capabilities) and provides system designers with a clearer parameter that is not a dynamic and changing parameter.

### 5.3.2 Percentage of Observations

Based on testing experience to date, the OVR V047 was updated to incorporate a percentage of detection observations for the lateral distance. The lateral distance of 3 nm (as measured from the primary display camera mast) remains and is now coupled with a percentage of detection observations of 50% or more. As more data is collected, a percentage of observations will be added to V076, V077, and other distance referencing OVRs.

### 5.3.3 Altitude

For V047 and V077, the altitude component was updated to align with the area of responsibility.

## 5.4 Straight-In Arrival OVRs

A new OVR, V092, was added and is as follows:

*The remote tower system must permit the controller to visually detect a known straight-in arrival aircraft at a minimum of 3 nm from the runway threshold.*

V092 must be met on the primary and/or secondary displays. The purpose of this additional OVR was to ensure the controller detects a known straight-in at an adequate distance to provide sequencing and spacing services.