Remote Towers Vendor Information Meeting

Presented to: Remote Tower Industry

By: FAA NextGen and Technical Operations

Date: March 16, 2023

Agenda

TIME	TOPIC	PRESENTER
2:00 PM – 2:10 PM	Introduction	Matthew Richardson
2:10 PM – 3:00 PM	RT Pilot Program Updates	
	Congressional Direction Recap/ RT Pilot Program Strategy	Matthew Richardson
	SDA & Commissioning Process Overview and Activities	
	SDA Process Timeline	
	SDA Roles & Responsibilities	
	SDA Application/ SDA Intake Process	Randy Key
3:00 PM – 3:50 PM	RT System Requirement Updates	
	OVRs V2.0 and V2.1 Updates	Katie Berry
	Functional Acceptance Evaluation Overview	
	AC, OVRs, & Technical Requirement Linkages	Shelly Beauchamp
	Technical Requirements V4.0	
	Non-Federal Remote Tower Website	
3:50 PM – 4:00 PM	Next Steps/ Upcoming Updates	Matthew Richardson

RT Pilot Program Updates

Congressional Direction Recap

Congress directed the FAA to establish an RT pilot program to:

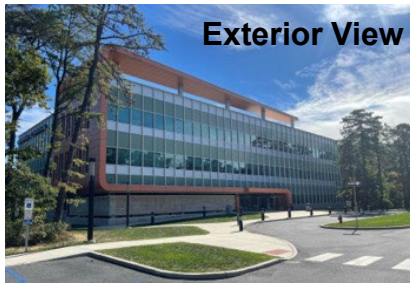
- **Evaluate technical and operational feasibility of applying RT technology in the NAS**
  - Conduct operational evaluations at select pilot sites to determine operational viability for use in the NAS
  - Initial sites are Class D, VFR airports, subsequent sites will evaluate system at more complex airports (e.g. multiple/crossing runways)
- **Establish minimum standards and a clear process for operational certification of RT**
  - Develop an Advisory Circular that defines the process to evaluate, Type Certify (i.e., System Design Approval), and Commission RTs
  - Develop associated technical system requirements/ standards
  - Create a Qualified Vendor System List (QVSL) of approved systems
- **Understand the business case of establishing and operating RTs in the NAS**
  - Comprehensive cost analysis to determine if RTs are a cost effective alternative to brick and mortar towers
  - Updated FAA Contract Tower (FCT) Benefit Cost model to determine if RTs meet requirement for entry into the FCT program

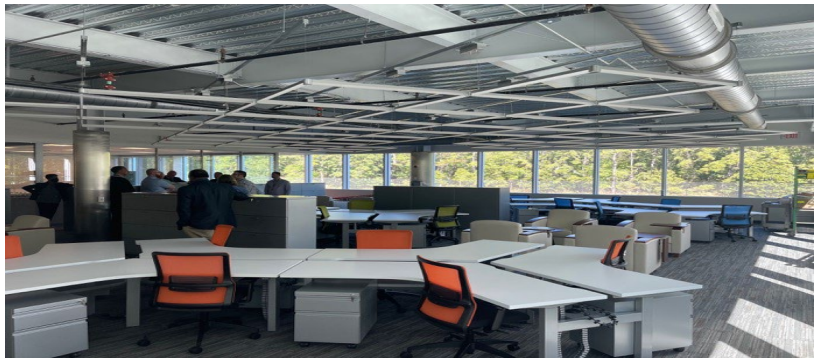
RT Pilot Program Strategy

- **Original Strategy**
  - FAA evaluates remote tower system at vendor/FAA selected locations (one-system/one-site approach)
  - Air traffic approvals limited to site specific configuration/layout
- **New Strategy**
  - As of September 2022, the FAA is no longer selecting individual airport pilot sites
  - Centralized testing and evaluation at the **RT testbed located** at the **National Aerospace Research and Technology Park (NARTP)***, and **Atlantic City International Airport (ACY)**
  - Vendor must pass **FAA Intake Review Process** prior to proceeding to the full System Design Approval (SDA) Process
  - Accelerates timeline in meeting goals of Congressional direction
  - Provides more robust evaluation of vendors' systems to allow FAA to explore the environmental and operational bounds of the utility of RT systems
  - Provides broader solutions to the RT marketplace in a timelier manner
  - Reduces risk to FAA and airport sponsors in the case the vendor system cannot meet FAA standards

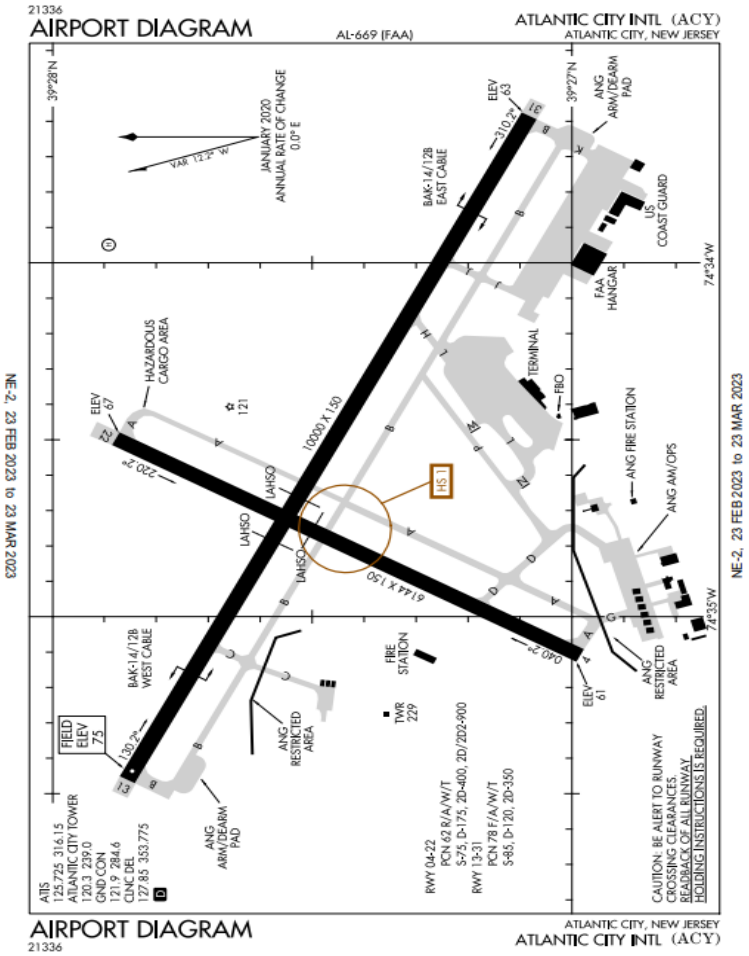
**Note: NARTP is located adjacent to the William J. Hughes Technical Center*

NARTP/ACY Testbed



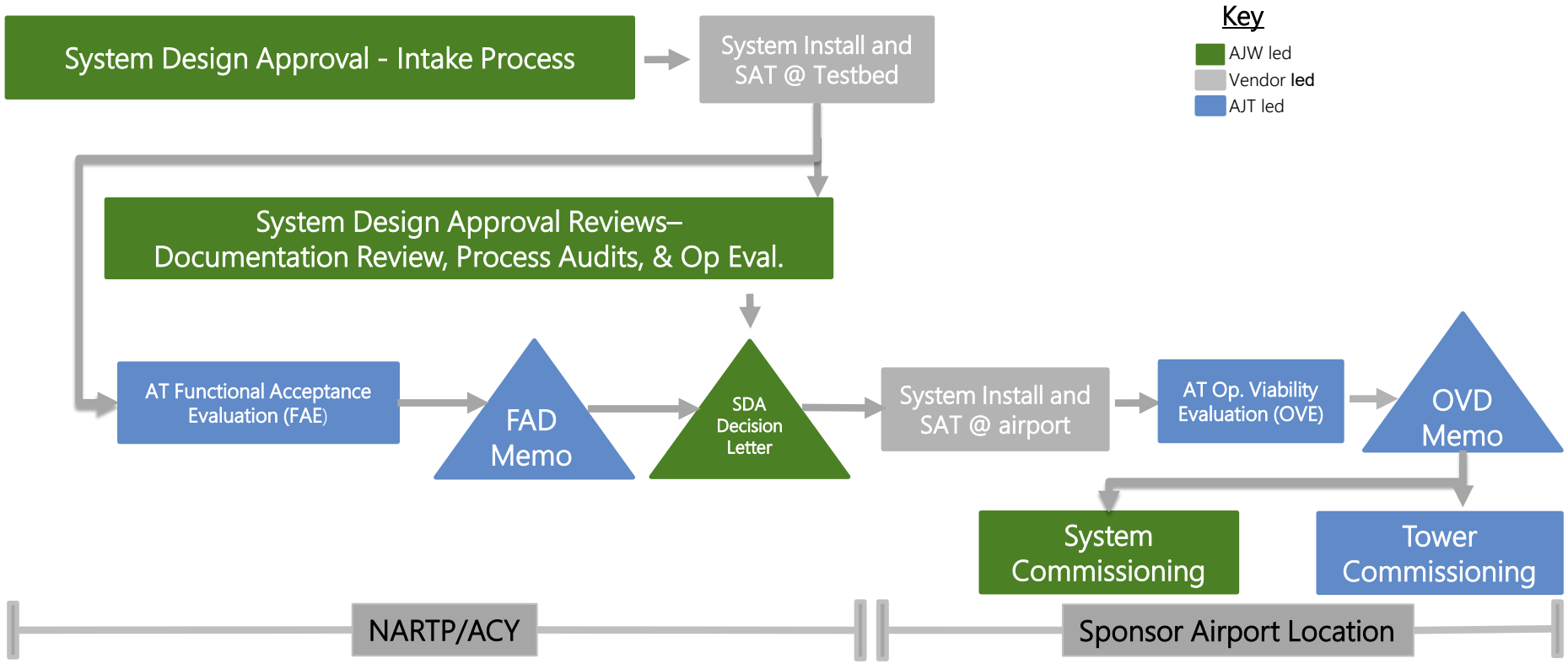


Remote Tower Center (RTC) @ NARTP, Bldg. 3



Remote Tower Airfield (RTA) @ ACY

SDA & Commissioning Process Overview

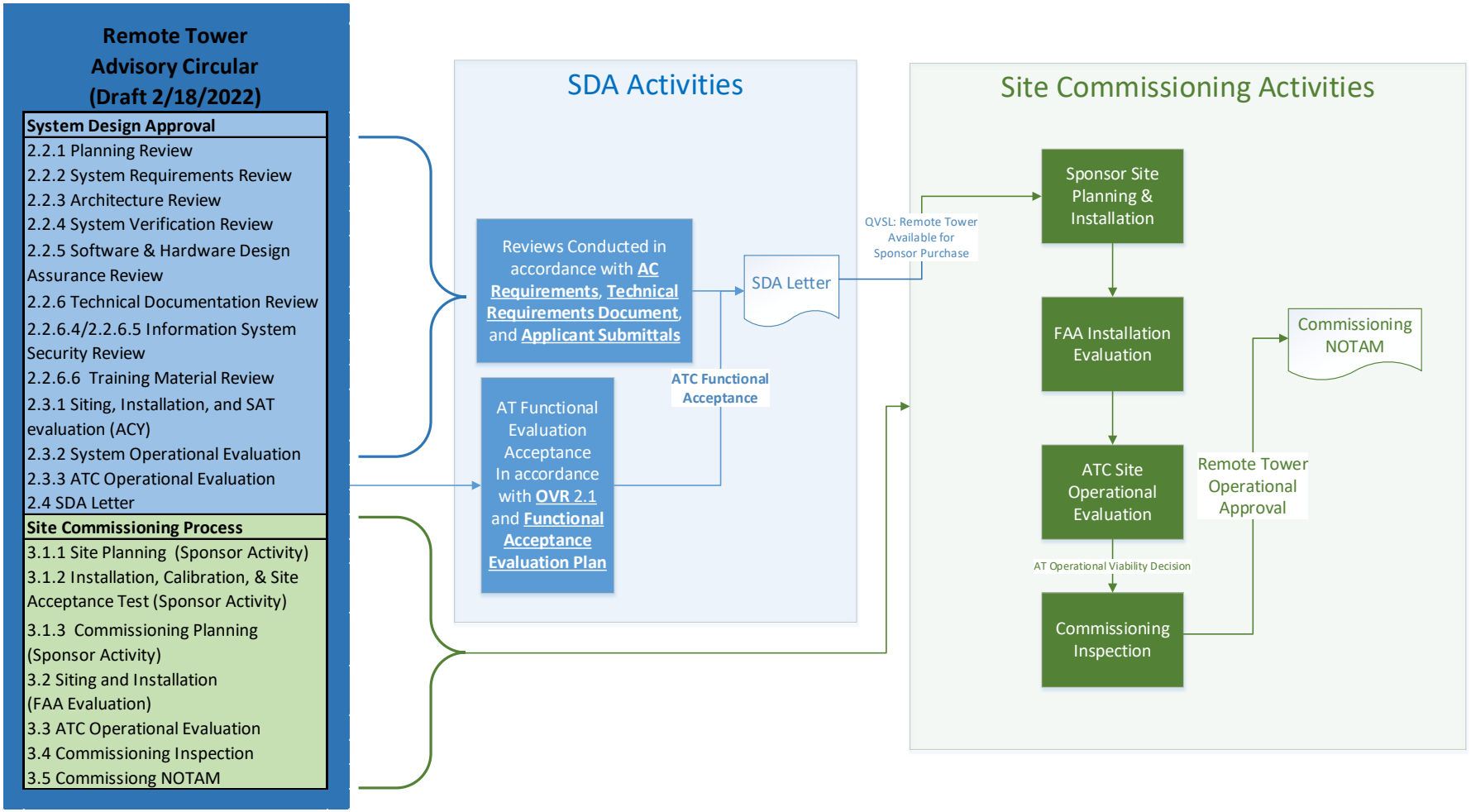


For a system to become operational in the NAS, the vendor system must obtain SDA AND successfully complete all Commissioning Activities

Notes:

- *SDA requires positive **AT Functional Acceptance Decision (FAD)**; FAD and SDA are achieved at the NARTP/ACY Testbed*
- *Once SDA is achieved system will be added to QVSL*
- *Commissioning requires positive **AT Operational Viability Decision (OVD);** OVD happens during the site acceptance and is site dependent (after SDA and QVSL)*

SDA & Commissioning Activities



Note: *This diagram shows* ***non-Federal RT System*** *SDA and Commissioning activities covered in the RT AC. ATCT commissioning activities are not shown.*
Note: *AC Section 2.3.3 is currently referred to as the ATC Op Evaluation. The AC will be updated to align with testing and current terminology as described in this briefing.*

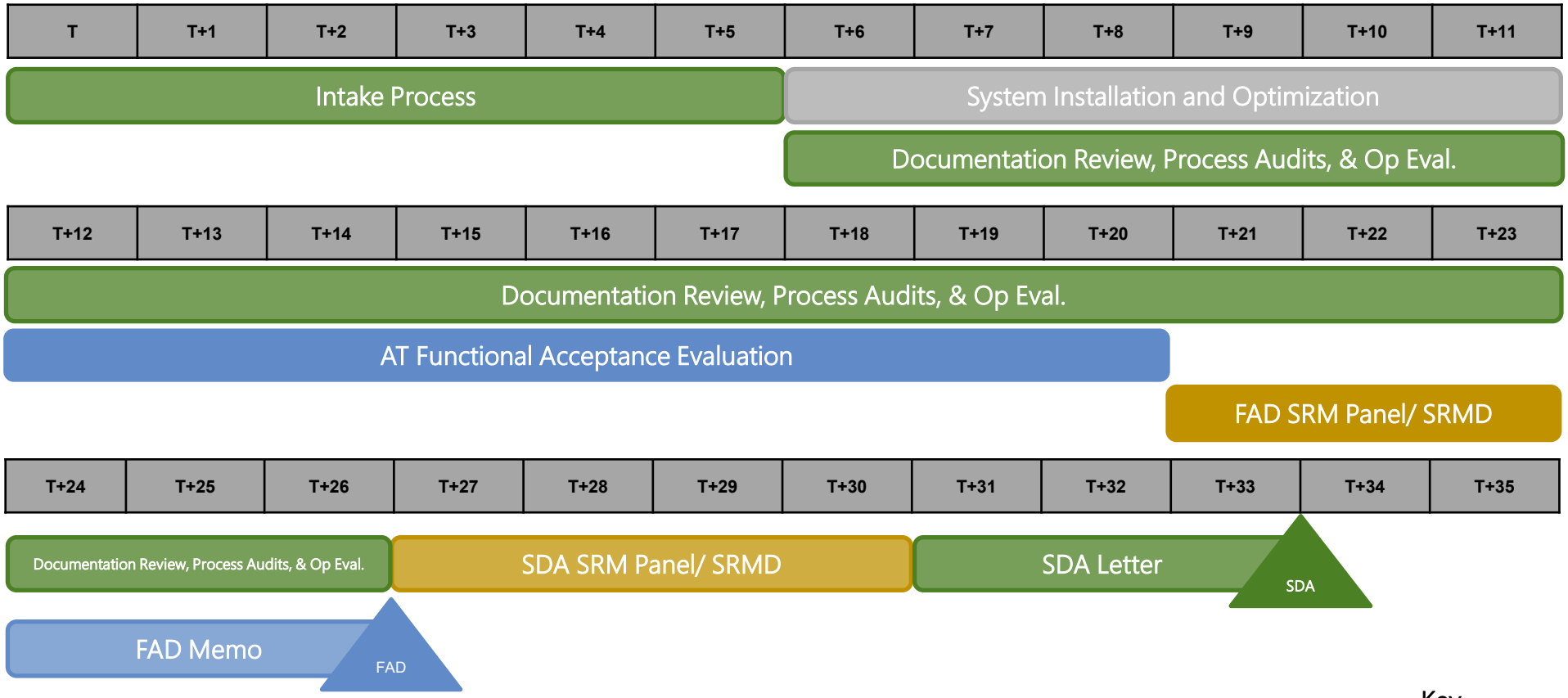
AJT Led Functional Acceptance Evaluations and Operational Viability Evaluations

- **SDA - Air Traffic Functional Acceptance Evaluations (FAE) at NARTP/ACY Testbed** (AC Section 2.3.3)
  - **Objective:** to obtain Air Traffic determination that system is usable in the NAS
  - **Success =** **Functional Acceptance Decision (FAD)** for SDA
  - Completed at the testbed to validate that all OVRs/other AT criteria are met
  - Robust passive data collection from RTC using scripted scenarios and Targets of Opportunity
  - Once SDA is achieved vendor system will be put on QVSL and airport can purchase

  NOTE: Airports will still need to complete the AC Commissioning Process, including AT Operational Viability Eval. at each site, before using the system in operations

- **Commissioning - Air Traffic Operational Viability Evaluations (OVE) at Each Site** (AC Section 3.3)
  - **Objective:** to obtain Air Traffic approval to commission the system for use at a specific airport to provide air traffic control tower services
  - **Success =** **Operational Viability Decision (OVD)** for site Commissioning
  - Completed at each airport to validate the system can be used in an active environment
  - Operational Viability Evaluation Plan TBD by AJT- will entail using RT system in active air traffic environment
  - Once site specific OVD is obtained the system can be fully Commissioned

SDA Notional Timeline



Schedule Dependencies:

- AJW bandwidth (i.e., number of vendors simultaneously completing Intake/SDA Process)
- Vendor's requirements for RTC/RTA testbed infrastructure
- Vendor's installation/optimization timeline
- Vendor's ability to timely deliver SDA documentation
- Quality of vendor's submitted SDA documentation

Key

- AJW led
- Vendor led
- AJT led
- AJI led

SDA Roles & Responsibilities

The following Roles and Responsibilities will be outlined in an Memorandum of Agreement (MOA) between FAA and Vendor. **All items are provided in-kind by the responsible party**. The MOA will be signed prior to RT system installation at the Remote tower testbed (i.e., the Remote Tower Center (RTC) located in the NARTP, and the Remote Tower Airfield (RTA) at ACY):

- **FAA**
  - Provide overall program management.
  - Submit required FAA 7460-1 and obtain other required construction permits.
  - Provide agreement on vendor's ACY field implementation initial design package.
  - Provide ACY field implementation site installation final design package.
  - Prepare and maintain testbed infrastructure.
  - Develop the operational evaluation plan(s)/report(s); and conduct necessary system evaluations and vendor system documentation reviews/audits for an FAA SDA decision.
  - Conduct all required Safety Risk Management activities.
  - Provide all air traffic controller Subject Matter Experts (SMEs) to participate in data collection activities.
  - Provide all required test aircraft required to execute scripted scenarios according to the FAA FAE plan.
  - Required non-RT equipment (e.g. MEL items).
  - Make SDA decision.

- **Vendor**
  - Provide program management for vendor led activities.
  - Provide ACY site survey report and field implementation initial design package.
  - Provide and install/remove, connect/disconnect RT system equipment to/from FAA's RT infrastructure at testbed.
  - Optimize and maintain all vendor provided RT equipment at the testbed.
  - Provide/conduct all required system training for controllers/evaluation team.
  - Provide input feedback to evaluation team on operational evaluation plan(s)/report(s).
  - Support all required Safety Risk Management activities.
  - Provide all system documentation needed to obtain an FAA SDA decision.

SDA Application

Approved Remote Tower systems are intended to be owned and operated by "sponsors" as non-Federal facilities in the NAS

- Focus of Remote Tower SDA submittals should be on enabling the operation of non-Federal remote tower systems in the NAS
  - SDA documentation submittals should not be tailored to the NARTP/ACY testbed installation
- SDA requires reviews of the proposed plans, procedures, and processes that will ensure the RT system can be sited, installed, commissioned, operated, and maintained safely in the NAS

SDA Intake Process

- **Initial screening review of the applicant and the proposed system**
  - Ensures that the applicant has the necessary processes, resources, infrastructure, etc. to successfully complete the development and approval process, and to provide acceptable lifecycle support processes for a safety critical Air Traffic Control (ATC) system
  - Ensures that the proposed system is suitable as a non-Federal facility in the NAS (e.g., no required connectivity to NAS facility/networks, no plan or requirement for additional FAA resources to support operations or maintenance, etc.)
- **Successfully passing the Intake Process is now a prerequisite for installation at the NARTP/ACY testbed for technical and air traffic evaluations**

Requested Intake Documentation (1 of 2)

Intake Submittal	Intent/Objective of Request
CONOPS	• Gain a general understanding of applicant's operational concept and plan forward
System Design Approval Plan	• Establish applicant's plan for managing a safety critical system development; • Identify organizational responsibilities; • Identify key artifacts to be produced; • Identify key milestones/schedule; etc.
• System Engineering Management Plan • Plan for Software Aspects of Assurance • Plan for Hardware Aspects of Assurance	• Ensure that the applicant has a firm grasp of aviation standards and practices associated with safety critical applications • Establish an understanding of key processes that the applicant intends to execute to show compliance with FAA remote tower technical requirements
System Requirements Specification	• Evaluate the applicant's ability to capture and formalize a broad set of system requirements

Requested Intake Documentation (2 of 2)

Intake Submittal	Intent/Objective of Request
Anticipated waivers and/or deviations against FAA Technical Requirements	• Identify programs risks and assess the likelihood of a successful SDA outcome given the anticipated waivers and/or deviations
System Characterization Document	• Identify high-level information system security information associated with the proposed design (e.g., system security boundaries, general network topology, proposed FIPS security ratings, proposed controls, etc.)
System Safety Assessment Documentation (as available)	• Assessment of system safety plans and products against current aviation system standards • Artifacts provided are anticipated to be dependent on the applicant's stage of development
Installation Guidance Documents	• Assess the applicant's siting requirements, installation procedure detail, safety requirements implemented in installation documentations, etc.

RT System Requirement Updates

Operational Visual Requirements (OVRs) Updates (V2.0 and V2.1)

- **V2.0**
  - Removed redundant OVRs
  - Updated OVRs referencing 3 nm
  - Updated display terminology
  - Updated distributed Mast – Secondary Display Use
  - Added detection OVR for straight-in arrival aircraft
- **V2.1**
  - Replaced “landing threshold” with “runway threshold”

V2.0: Removed Redundant OVRs

- **Three redundant OVRs were removed**
  - 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)
- **Three related OVRs remain in V2.0**
  - Must be met on the primary display

V2.0: Updated OVRs Referencing 3nm

Update Summary

- Changed reference location from active runway surface area to primary display mast
- Updated altitude component to area of responsibility
- Updated percentage of observations for one OVR

Resulting Updated OVRs

- 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*.
- 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*.
- 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.

V2.0: Updated Display Terminology (1 of 2)

- **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.

V2.0: Updated Display Terminology (2 of 2)

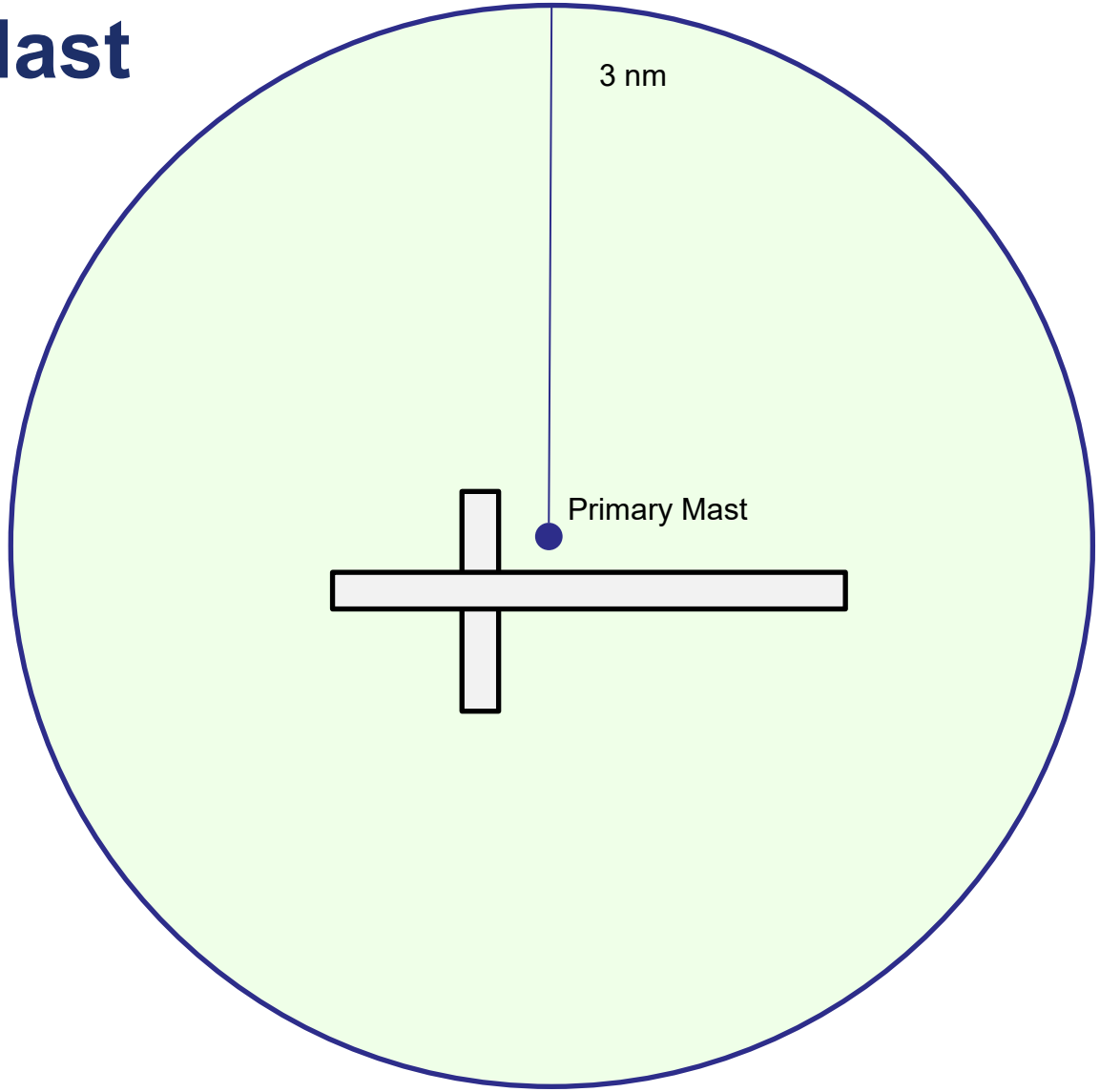
- **A display, as defined for an RT System, can consist of a screen(s) or window(s) depicting a continuous view to the user. Spatial relationships must only be observed and determined from the same field of view depicted on the same classification of display (primary, secondary, or tertiary). In this 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.**

Refer to OVR document for full list of OVRs with displays determination.

V2.0: Updated Distributed Mast – Secondary Display Use & New OVR for Straight –In Arrivals

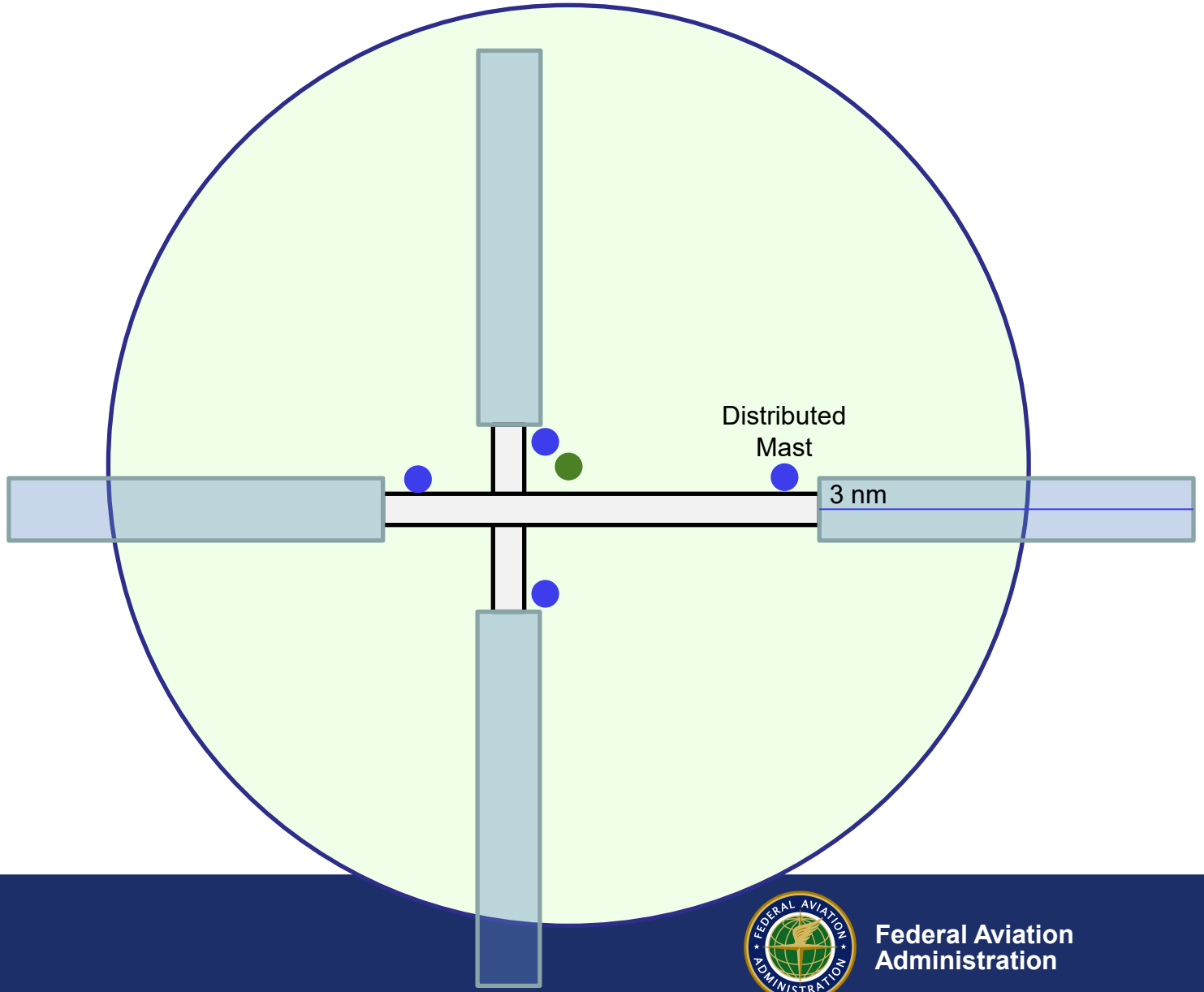
- **OVRs that can be met on the secondary display or primary display**
  - Recognizing an aircraft or vehicle on the movement area (V005, V007, V058-059, V063-064)
  - Verifying aircraft category, direction, relative altitude, the relative speed from the runway threshold
- **New OVR for detecting straight-in arrivals**
  - 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.

Primary Mast



Not to Scale

Secondary Display OVRs with 4 Distributed Mast



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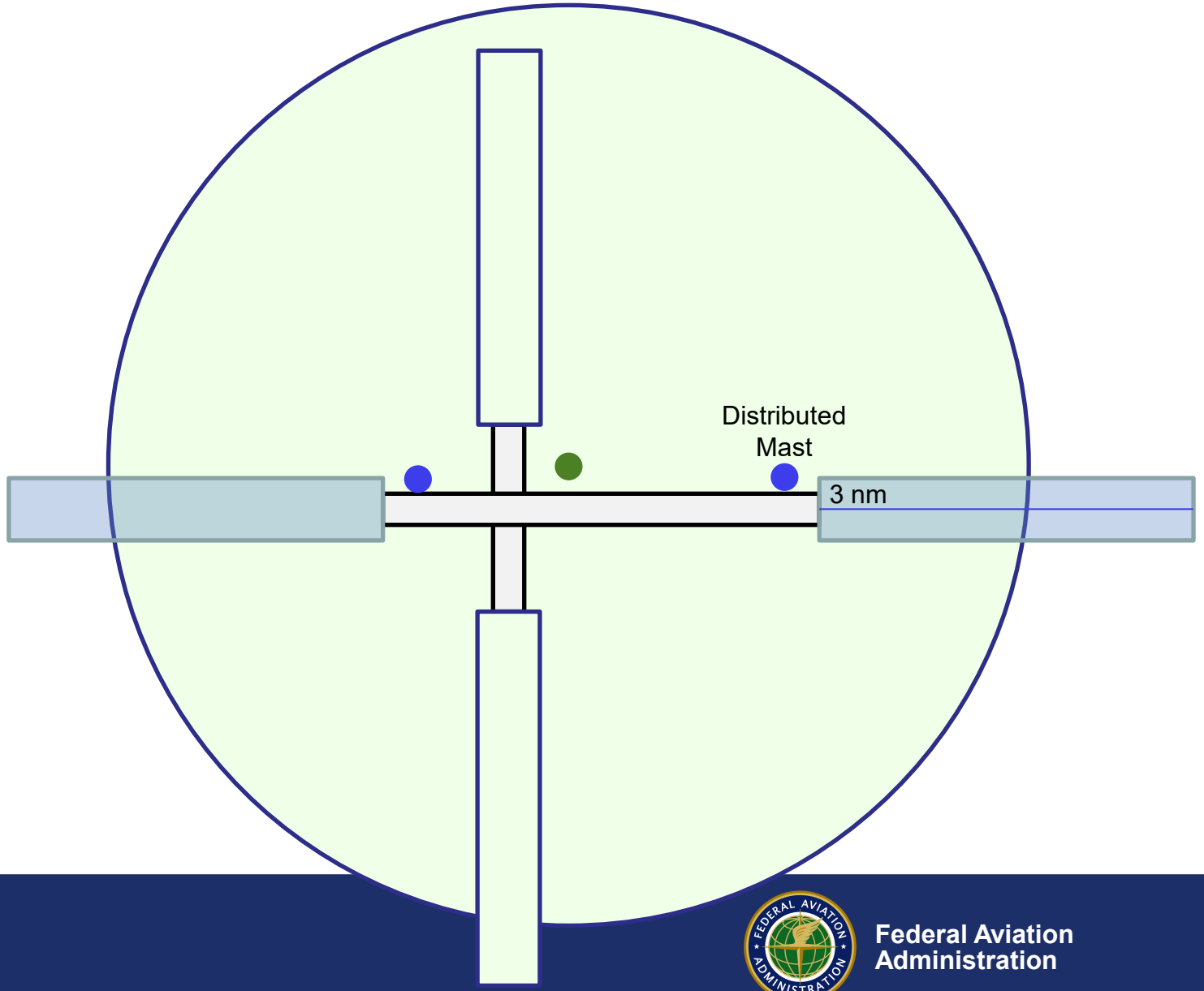
Secondary Display OVRs with 2 Distributed Mast



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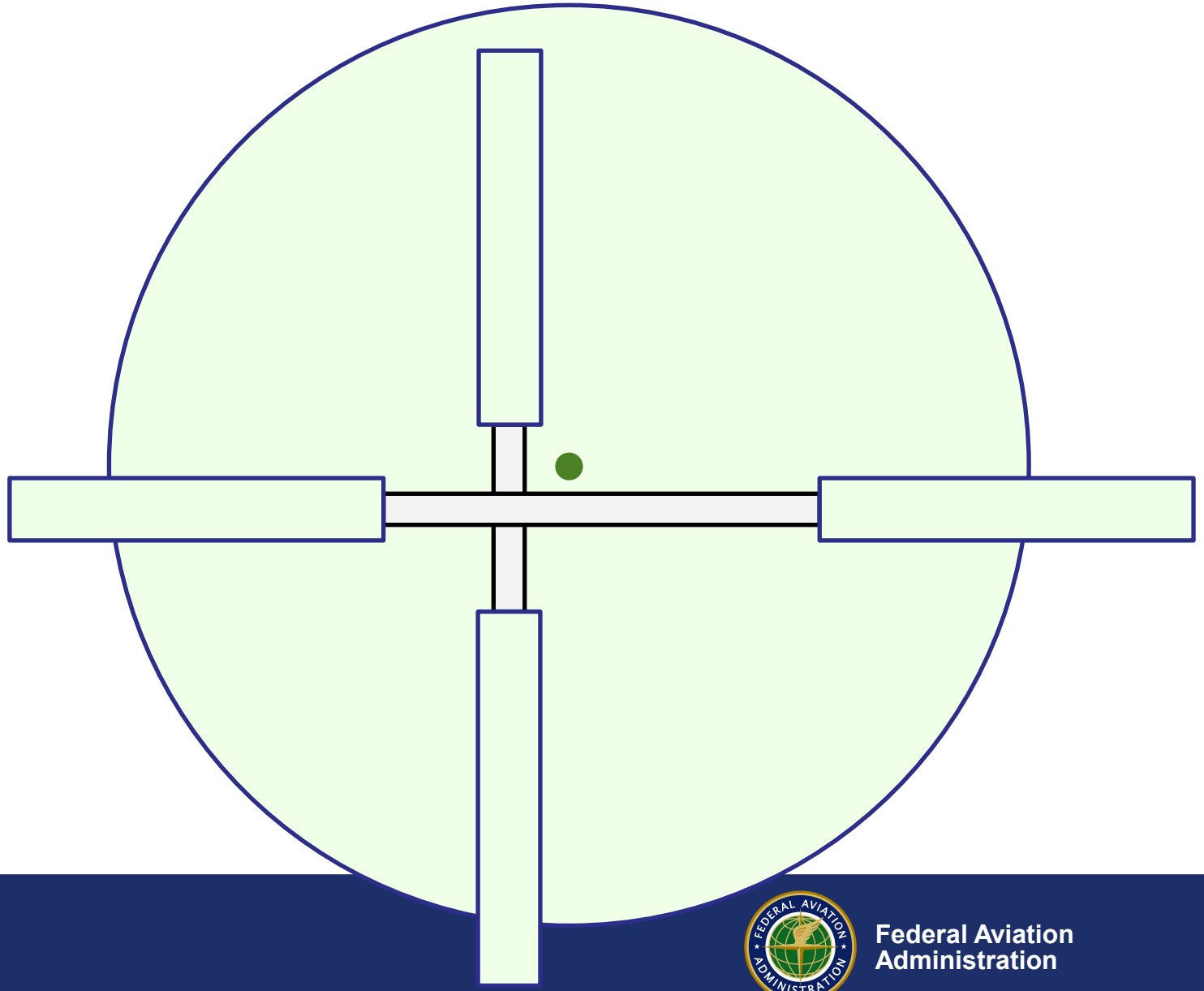
Secondary Display OVRs with Primary Mast Only



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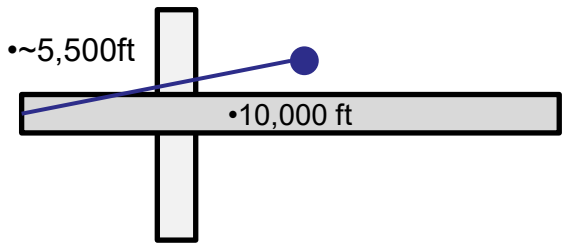
Functional Acceptance Evaluation Overview

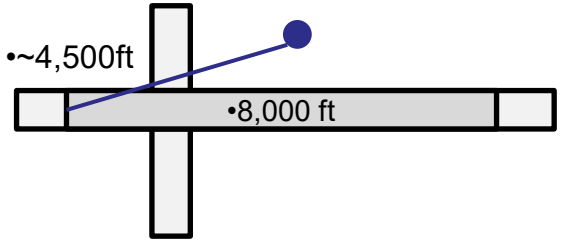
- **Determination of if the RT system can functionally permit the controller to utilize the RT system visual information to meet the OVRs under various airport parameters**
- **Conducted at NARTP/ACY RT testbed; ACY permits for the envelope of airport parameters to be evaluated**
  - Runway configurations
  - 10,000 ft runway

Distance From Primary Display Mast

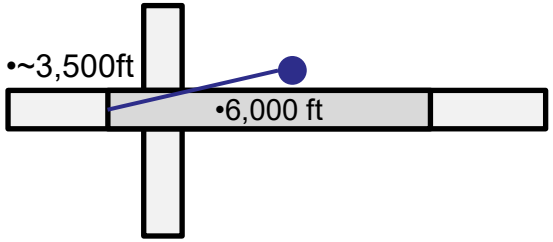


•Pattern for 10,000 ft RWY

•Not to Scale

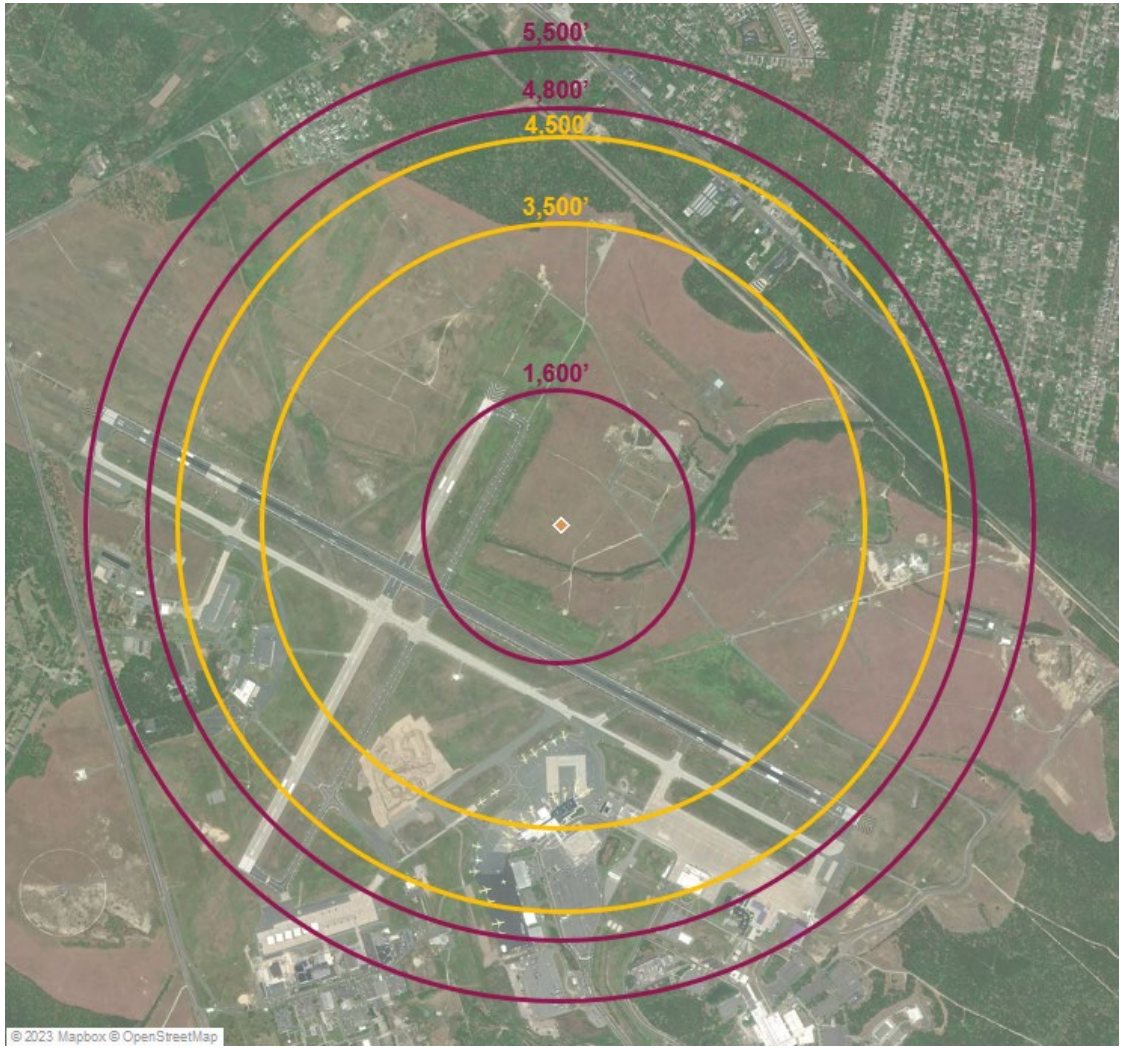


•Pattern for 8,000 ft RWY



•Pattern for 6,000 ft RWY

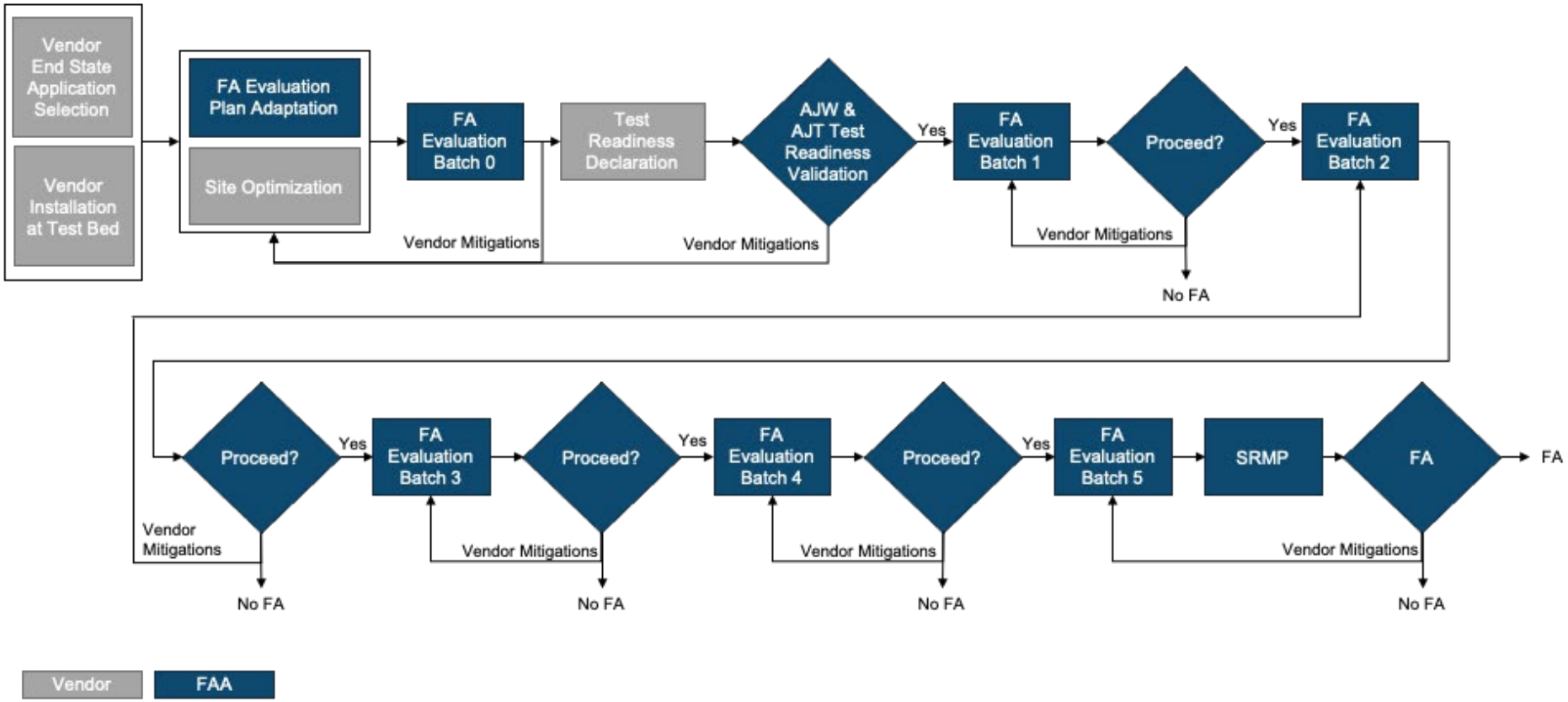
Distance From Primary Display Mast at ACY



Naturally occurring distances at ACY

Emulated distances at ACY

Overview of Functional Acceptance Evaluation



Batch Testing Overview

- **Batch 0: HMI Optimization and Test Readiness**
- **Batch 1: Ground Observations & Initial Airborne Visual Acuity**
- **Batch 2: Pattern & Initial Airborne Observations**
- **Batch 3: Airborne Observations & Same Runway Separation**
- **Batch 4: Multiple Runway Separation & Helicopter Observations**
- **Batch 5: Workload & Simulated Immersion**
- **Batch ToO: Weather & Visibility**

Batch Testing Details

Batch	Test	Details	
Batch 1: Ground Observations & Initial Airborne Visual Acuity	Test 1	**Title**	Ground Movement Observations of Taxiing Aircraft and Vehicle
		ID	Batch 1, Test 1
Batch 2: Pattern & Initial Airborne Observations Batch 3: Airborne Observations & Same Runway Separation Batch 4: Multiple Runway Separation & Helicopter Observations Batch 5: Workload & Simulated Immersion Batch ToO: Weather & Visibility	Test 2 Test 3 Test 4 Test 5 Test 6 Test 7	**Description**	Multiple aircraft and vehicles taxi on/near the movement area, including the taxiway, runway, runway safety area, hot spots, and intersections. Vehicle operates on/near the movement area and conducts runway sweeps. Test participants make visual observations at various visible locations.
		Objectives	Ensure controllers can use the RT system to make ground observations for nominal ground operations.
		OVR Links	V001, V002, V003, V004, V005, V006, V007, V008, V009, V010, V011, V012, V016, V027, V056, V057, V058, V059, V063, V064, V065, V066, V080, V081, V082, V083
		Prerequisites	Test Readiness Declaration and Verification
		AC/Vehicle Minimum Requirements	2 Category 1 Aircraft & 1 Airport Operations Vehicle
		Time of Day	Day
		Minimum Amount of Data	50 aircraft observations at select visible locations and 25 vehicle observation at select visible locations
		Duration	8 hours
		Pass/Fail Criteria	95% of visual observations made at each location

RT Technical Requirements Updates (V4.0) (1 of 2)

Note: Version 4.0 of the Technical Requirements is compatible with Version 1.0 of the OVRs at single runway environments. A future update will align these documents.

- **Reorganized content**
  - Clarification of definitions and terminology
  - Introduction of concepts and activities in a more logical flow
  - Consolidation & elimination of notes
  - Removal of redundant requirements
- **Environmental mitigations and ancillary equipment**
  - Provides definitions and cleans up terminology
- **Magnification and SLG requirements**
  - Consolidation and Simplification
  - Updates to make requirements end-to-end rather than individual functionality requirements
- **Test Case Appendix**
  - The test cases are guidance that provide an acceptable means of compliance for certain key technical requirements
  - Topics include latency, time-to-annunciate, continuity, and system-level visual performance requirements

RT Technical Requirements Updates (V4.0) (2 of 2)

- **RVP Performance Capability Requirements**
  - Requirement R0180, which pointed to the system's capability to meet all Operational Visual Requirements (OVRs), has been removed from this document
    - **Requirement to meet all OVRs is now linked to the Air Traffic Functional Acceptance Evaluation as described in Section 2.3.3 of the Advisory Circular.**
    - **NOTE: AC Section 2.3.3 is currently referred to as the ATC Op Evaluation. The AC will be updated to align with testing and current terminology as described in this briefing.**
    - **NOTE: ALL OVRs MUST STILL BE MET TO ACHIEVE REQUIRED AIR TRAFFIC FUNCTIONAL ACCEPTANCE DECISION**
  - 8 System-Level Visual Performance Requirements were added
    - Verification of these requirements is the responsibility of the vendor
    - Pass/fail criteria based on acceptable visual performance at a measurable maximum line-of-sight distance to standardized scaled targets
    - Intended Benefits
      - Provide a future (i.e. post-pilot program) means to gain incremental confidence in the system capability prior to extensive Air Traffic evaluations
      - Provide a means to assess the system's visual capture, processing, and display chain without impacting an operational airport environment
      - Provide repeatable verification activities to assess the impact of post-SDA approval modifications on the system

Non-Federal Remote Tower Website Update

- **Reformatted for clarity**
- **Now provides a mapping of compatible documentation**
- **Links to available safety assessments, requirements, and the Intake form**
- **Updated documentation will be posted to the website as available**

https://www.faa.gov/airports/planning_capacity/non_federal/remote_tower_systems

Next Steps/ Upcoming Updates

- **Detailed testbed FAE Plan**
- **RT Siting Guidance**
- **Commissioning Process**
  - Timeline
  - Roles and Responsibilities
  - Site specific OVE overview
- **Operational Safety Assessment (OSA) for multiple runway airports to inform updates to Technical Requirements**
- **Technical Requirements V5 to align with OVR 2.1**
- **Updated AC to align to latest requirement documents and terminology**

Federal Aviation Administration

THANK YOU

Presented to: Remote Tower Industry

By: FAA NextGen and Technical Operations

Date: March 16, 2023

Back Up

Acronyms

- AC- Advisory Circular

- RTC- Remote Tower Center
- RTA- Remote Tower Airport
- NARTP- National Aerospace Research & Technology Park (testbed RTC)
- ACY- Atlantic City International Airport (testbed RTA)

- OVR- Operational Visual Requirements
- FAE- Functional Acceptance Evaluation (at testbed)
- FAD- Functional Acceptance Decision (for SDA)
- SDA – System Design Approval

- OVE- Operational Viability Evaluation (at each site)
- OVD- Operational Viability Decision (for Commissioning)