Vendor Feedback Meeting

with
Established Remote Tower System Developers

July 21, 2021

Federal Aviation Administration

Agenda/Topics

Time	Session
9:00 AM 10 min	**Westley Wright** | FAA NextGen Technology Development & Prototype Division Manager *Introductory Remarks*
9:10 AM 10 min	**Mitchell Bernstein** | FAA NextGen Overarching PM for Remote Towers *Briefing: FAA Remote Tower Pilot Program*
9:20 AM 10 min	**Shelly Beauchamp** | FAA Technical Operations Manager, Advanced Systems Design Service team *Briefing: FAA Remote Tower Non-Federal System Approvals & Implementation*
9:30 AM 10 min	**Mitchell Bernstein & Shelly Beauchamp** | FAA NextGen & Technical Operations *Q&A Session*
9:40 AM 40 min	**Randy Key** | FAA Technical Operations Technical Lead, Advanced Systems Design Service Team *Briefing: Draft Advisory Circular (AC)*
10:20 AM 15 min	**Randy Key** | FAA Technical Operations *Q&A Session*
10:35 AM 20 min	**Coffee Break**

Time	Session
10:55 AM 40 min	**Randy Key** | FAA Technical Operations *Briefing: Draft Technical Requirements Document*
11:35 AM 15 min	**Randy Key** | FAA Technical Operations *Q&A Session*
11:50 AM 5 min	**Shelly Beauchamp** | FAA Technical Operations *Wrap-Up*
11:55 AM 5 min	**Closing Remarks**

Note: This event is being recorded. The recording will be posted to a public FAA website

FAA Remote Tower
Pilot Program

RT Pilot Program Overview

➢ **Congressional Direction for Remote Tower Pilot Program**

➢ **Pilot Program Strategy**

➢ **Pilot Site Objectives/Goals**

➢ **Current RT Evaluations**

  – Site #1 Leesburg Executive Airport (JYO), Leesburg, VA

  – Site #2 Northern Colorado Regional (FNL), Fort Collins, CO

➢ **Standards/Advisory Circular Development**

➢ **Summary**

Congressional Direction

In the FAA Reauthorization Act of 2018 Section 161, Remote Tower (RT) Pilot Program for Rural and Small Communities, Congress directed the FAA to establish an RT pilot program to:

- ➢ Evaluate the technical/operational feasibility of applying RT technology in the NAS

- ➢ Establish minimum standards and a clear process for operational certification

- ➢ Understand the business case

Congress offered selection criteria for consideration:

- ➢ 3 airports that are not primary airports and are not towered *(pilot site #1 - JYO, site #2 - FNL)*

- ➢ 1 non-hub airport *(pilot site #2 - FNL)*

- ➢ 1 airport that participates in the Contract Tower Program *(pilot site #3, site #4, site #5)*

- ➢ 1 airport selected at the discretion of the Administrator *(pilot site #6)*

- ➢ At least 2 different vendors of remote tower systems participate *(SAAB and Searidge Technologies so far)*

Pilot Program Strategy

➢ **The FAA is working with multiple vendors via public-private partnerships to evaluate existing vendor developed remote tower systems at selected airport sites**

➢ **Pilot Sites #1 & #2: already underway (i.e. JYO, FNL)**

➢ **Taking a linear approach to evaluating remote towers at the subsequent sites**
  – Site #3 will begin after the system at site #1 is receives air traffic operational viability decision
  – Sites #4-#6 will assess RTs in more complex airport environments/runway configurations

➢ **Pilot Sites #3-#5: focus on selecting an airport with an aging, FAA-owned Federal Contract Towers (FCTs) in close proximity to FAA headquarters in Washington, DC**
  – FAA-owned reduces program risk in case of unsuccessful evaluation and subsequent system removal
  – Existing towers have seasoned controllers, back-up tower for testing, and performance/cost baseline
  – Sites close to DC area provides easier site access/reduced travel costs to support evaluations

➢ **Pilot Site #6: the current plan is to select an Instrument Flight Rule (IFR) airport**

➢ **Final site selection decisions will be in accordance with the specific research objectives (e.g. proving concept for more complex airports) for each subsequent site**

Pilot Site Objectives/Goals

- **Pilot Site #1: SAAB/JYO**
  - Evaluate developmental system #1 (SAAB) at JYO to determine if it is operationally acceptable for a Visual Flight Rule (VFR) tower
  - Define non-federal RT standards and associated approval process

- **Pilot Site #2: Searidge Technologies/FNL**
  - Evaluate developmental system #2 (Searidge) at FNL to determine if it is operationally acceptable for a VFR tower
  - Refine non-federal RT standards and associated approval process

- **Pilot Site #3: Vendor/Site TBD**
  - Apply and validate type certification process and associated standards
  - Determine actual costs and timeline for non-developmental implementation
  - Apply and validate a camera siting process for remote towers

Pilot Site Objectives/Goals Cont.

- ➢ **Pilot Site #4-#5: Vendor(s)/Site(s) TBD**
  - Evaluate remote towers at more complex airports (e.g. multiple runways, crossing runways and/or higher number of air traffic operations)
  - Prove the concept, identify requirements, and develop business case for use of RTs at more complex airports

- ➢ **Pilot Site #6: Vendor/Site TBD**
  - Expand on the remote tower concept and business model for IFR airports (e.g. airports with a need to add second tower to accommodate a newly built distant runway).
  - Prove the concept, identify requirements, and develop business case for use of RTs to supplement the out-the-window view at IFR airports

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Site #1: SAAB's JYO RT

Remote Tower Center

(748 Miller Drive, Suite G-3

Leesburg, VA)

•360° Panoramic view

5500 x 100

17

35

Remote Tower Module
(Equipment, console, and displays)

Camera Mast on

JYO Terminal
Bldg.
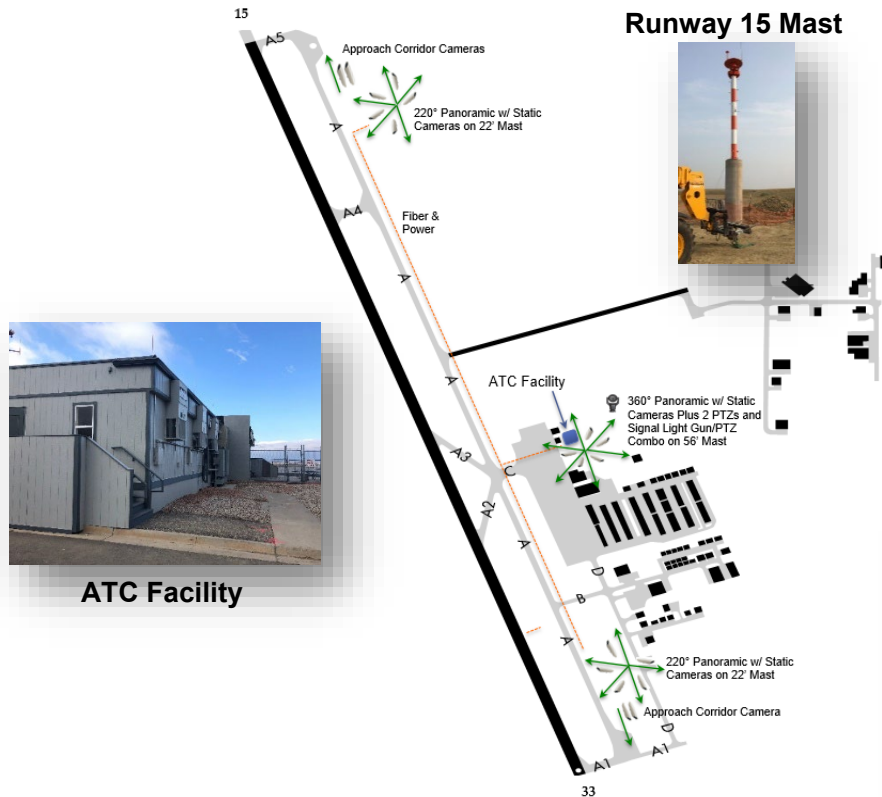
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Site 1: JYO Evaluation Status

➤ **2015-2017: Phase 1 passive RT evaluations while Mobile Air Traffic Control Tower (MATCT) controlled traffic**

➤ **2017: Phase 2 active RT evaluations with MATCT staffed as backup**

➤ **2018- 2019: Phase 3 Verification and Validation (V&V) - RT actively controlling traffic, MATCT not staffed**

➤ **2019 – 2021: RT Control Room relocated to an off airport property**
  – MATCT controlled traffic during this time
  – There were construction delays due to Covid-19

➤ **2021:   Complete Phase 3 V & V activities**
  – Feb 8-10 and Feb 16-17, 2021: Passive Comparative Visual Detection test conducted at JYO
  – April 26, 2021: Active control of traffic from the new RT facility location
  – May 10-23, 2021: FAA observers conducted the final Verification and Validation (V&V) activities
  – June 22, 2021: Safety Risk Management Panel reviewed V&V data and verified risk levels

➤ **September 30, 2021: Expected AJT operational viability decision**
  – Render AJT's decision on the ATCT services that can be provided using the RT system at JYO in environments similar to JYO
  – With a positive Operational Viability decision and development of technical requirements, the FAA and vendor will plan and schedule FAA Approval of JYO Vendor System
  – JYO airport authority intends to apply for acceptance into FCT program with the RT
    • *Note: In October 2020, JYO was accepted into the FCT program to use a brick-mortar tower*

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Searidge's FNL RT Installation

Runway 15 Mast

Center Mast

ATC Facility

Approach Corridor Cameras

220° Panoramic w/ Static Cameras on 22' Mast

Fiber & Power

ATC Facility

360° Panoramic w/ Static Cameras Plus 2 PTZs and Signal Light Gun/PTZ Combo on 56' Mast

220° Panoramic w/ Static Cameras on 22' Mast

Approach Corridor Camera

Runway 33 Mast

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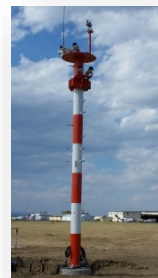
Site 2: FNL Evaluation Status

➤ **Fall 2018: Initial evaluation of the newly installed RT system to inform system optimization**

– The FAA provided feedback on system to inform optimization

– Searidge developed plan to optimize system

➤ **2018-2019: Searidge optimizing system**

– Test readiness review underway

– MATCT to be deployed at airport to provide control tower services during passive data collection

➤ **2020-2021: Evaluations on hold due to Covid Travel Restrictions:**

– April 2020: Originally planned Passive RT evaluations scheduled for April 2020

– In meantime, limited RT passive data collection activities were conducted virtually - Serco controllers on site, FAA evaluation team observed virtually

➤ **2021: Operational Evaluations Resume**

– Aug-Sept 2021: RT Passive evaluations will be conducted*

– Oct.-Dec. 2021: FAA will analyze data collected during the passive evaluation and hold safety panel to evaluate hazards and risks associated with moving to active testing of testing

– Beginning Oct 2021: airport construction will require taxiway closure/back taxiing on runway; for safety reasons no RT evaluations can occur during this time

– April/May 2022: RT Active evaluations planned

Note: unrelated airport construction requires MATCT to be relocated; schedule is dependent on relocation being completed by August 10th

Remote Tower Standards & Advisory Circular Development Process

Standards Development Status

- **Operational Visual Requirements (OVRs)**
  - Support the Operational Viability determination of systems providing services at Class D VFR, single runway airports
  - Version 1.0 (for Class D VFR, single runway airports) completed July 2019
    - Example: 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. (V048)

- **Advisory Circular (AC)**
  - AC Provides guidance to vendors for requirements, processes, and documentation required for type certification
  - AC Draft one completed December 2019; will still require verification and validation

- **Technical Requirements**
  - Basis for type certification decision
  - Version 2 (for Class D VFR, single runway airports) delivered June 2021; vendor feedback session conducted July 2021; 60 day vendor comment period in progress

- **RT Camera siting process**
  - Prototyping a tool for cameras modeled after current brick and mortar tower Visibility Analysis Tool (VAT)
  - Evaluating current visual siting process (including siting criteria and hazards) to identify gaps that need to be addressed/updates needed for RTs (cameras)

Summary

- ➢ **FAA will continue to apply systematic Safety Risk Management (SRM) approach to RT evaluations at pilot sites**

- ➢ **Existing locations (JYO, FNL) are of developmental nature**

- ➢ **Once JYO obtains operational viability decision, FAA plans to expand envelope of use cases at additional pilot sites**

- ➢ **FAA simultaneously developing & validating performance standards/certification process/AC and business case for various airport applications**

- ➢ **FAA simultaneously developing a remote tower camera siting criteria/process to support installation at subsequent airports**

FAA Remote Tower

Non-Federal System Approvals & Implementation

Advanced Systems Design Service (ASDS) Team

- **The ASDS team is responsible for:**
  - Non-Federal Program policy
    - Non-Federal systems' approval and oversight
  - Coordinating the review and approval of non-Federally developed technologies & systems prior to their use in the NAS
    - Legacy Non-Federal NavAids & VisAids (ILS, VOR, RVR, DME, NDB, etc)
    - Non-Federal AWOS
    - Emerging Non-Federal Technologies (Ground Based Augmentation System (GBAS), **Remote Towers**)
    - Potential Future Systems: UAS/UTM Ground Support Equipment (Surveillance, Nav, etc)

Non-Federal Systems Overview

- **Remote Towers is currently planned as a Non-Federal system in the NAS.**

- **A Non-Federal system is a system owned and operated by a "Sponsor".**

    - A sponsor can be a State or Local government, U.S. possession or territory, airport authority, or private interest.

- **Sponsors must procure, install, and operate only systems and equipment that are FAA approved, whether the facility is for public or private use.**

- **The FAA Non-Federal Program provides oversight through:**

    - Type certifications/System Design Approvals (SDA)

    - Commissioning & periodic ground inspections

    - Commissioning & periodic flight inspections (for applicable systems)

    - Verification of non-federal technicians

- **FAA Non-Federal Policy is documented in Order 6700.20 "Non-Federal Navigational Aids, Air Traffic Control Facilities, and Automated Weather Systems"**
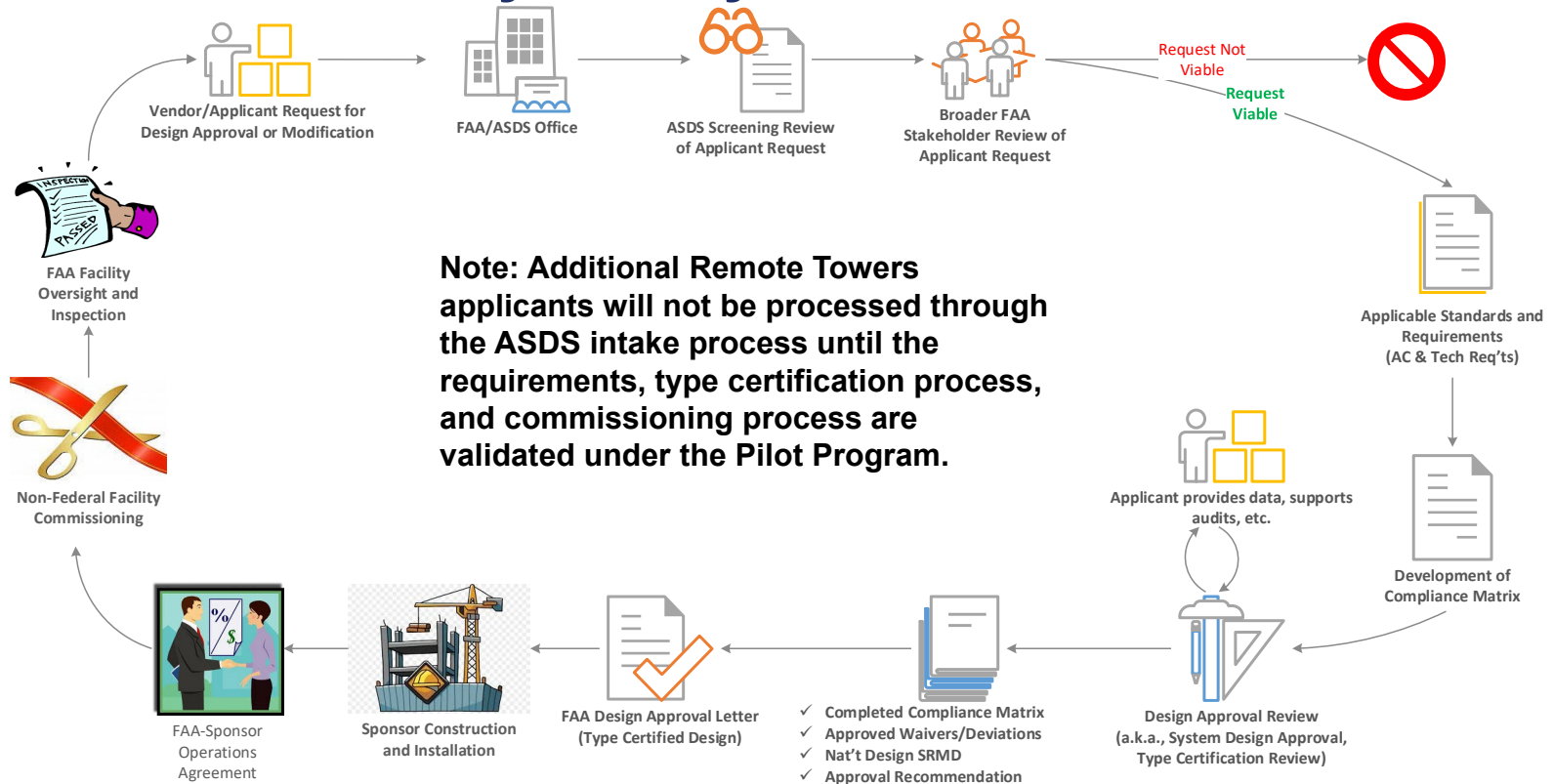
Non-Federal Implementation Process

- **Type Certification/System Design Approval (National)**
  - Applicant (manufacturer, vendor) requests approval of system
  - ASDS team coordinates review of intake material and determines viability and prioritization of project
  - Applicant works with FAA to provide required documentation and demonstration to show compliance to system requirements
  - FAA issues approval letter to vendor for system to be operated by Non-Federal Sponsors in the NAS
- **Operational Approval (At each implemented system site)**
  - FAA Inspectors receive approved training on system
  - Non-Federal technicians receive training to maintain system and pass an FAA performance exam
  - OMM is signed by sponsor. The OMM documents the responsibilities of the sponsor in operating the system.
  - Commissioning ground inspection is conducted
  - System is commissioned (*Note – For Remote Towers, system commissioning may not be effective until the tower facility is commissioned.)
- **Oversight (At each implemented system site)**
  - Periodic Inspections (generally annual) will be conducted by FAA Inspectors
  - The FAA has the authority to NOTAM the system out of service if the sponsor is not fulfilling their responsibilities as documented in the OMM, or if the system is not being maintained as required to provide safe services.

Non-Federal Facility Life Cycle

Vendor/Applicant Request for Design Approval or Modification

FAA/ASDS Office

ASDS Screening Review of Applicant Request

Broader FAA Stakeholder Review of Applicant Request

Request Not Viable

Request Viable

Applicable Standards and Requirements (AC & Tech Req'ts)

Development of Compliance Matrix

Applicant provides data, supports audits, etc.

Design Approval Review (a.k.a., System Design Approval, Type Certification Review)

✓ Completed Compliance Matrix
✓ Approved Waivers/Deviations
✓ Nat'l Design SRMD
✓ Approval Recommendation

FAA Design Approval Letter (Type Certified Design)

Sponsor Construction and Installation

FAA-Sponsor Operations Agreement

Non-Federal Facility Commissioning

FAA Facility Oversight and Inspection

Note: Additional Remote Towers applicants will not be processed through the ASDS intake process until the requirements, type certification process, and commissioning process are validated under the Pilot Program.

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Remote Towers – FAA Preparation for Type Certification Projects

- **Prerequisite work was required by the FAA prior to beginning formal type certification work for Non-Federal Remote Towers**
  - Document a process for system approval, commissioning, and oversight of RT systems
    - Draft *"Advisory Circular: Remote Tower (RT) Systems for Non-Federal Applications For Use in Class D/E VFR Airspace"* (previously distributed)
  - Define a set of minimum requirements for RT systems to which all applicants will have to show compliance
    - Operational Safety Assessment (complete)
    - Safety Requirements Allocation Document (in work)
    - Draft Technical Requirements Document (previously distributed)
      - Reference Operational Visual Requirements Version 1.0

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Meeting Goals

- **Provide potential RT vendors with status of FAA work towards supporting RT system approval projects**

- **Provide an overview of distributed Draft Advisory Circular & Technical Requirements documents**

- **Solicit comments and concerns regarding these documents from companies that have developed a Remote Air Traffic Control Tower system that is either operational or under testing**

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FAA Remote Tower System
Draft Advisory Circular (AC)

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Remote Tower System Advisory Circular (AC)

- **Scope**
  - AC Applies only to RT System
    - Does not address other equipment in the ATC facility
    - Does not address ATC service approval
  - Visual only Remote Tower (RT) System
    - No integrated surveillance allowed
    - No stand-alone surveillance assumed
    - Point-to-Point network
      - "Closed network" between the Airport and RT center
      - No consideration for multiple airports being serviced at a single RT center
  - Class D Airspace
  - Single Runway Airports

Note: AC and Technical Requirement Documents will be updated as the FAA Pilot Program explores additional operational scenarios

Remote Tower System Advisory Circular
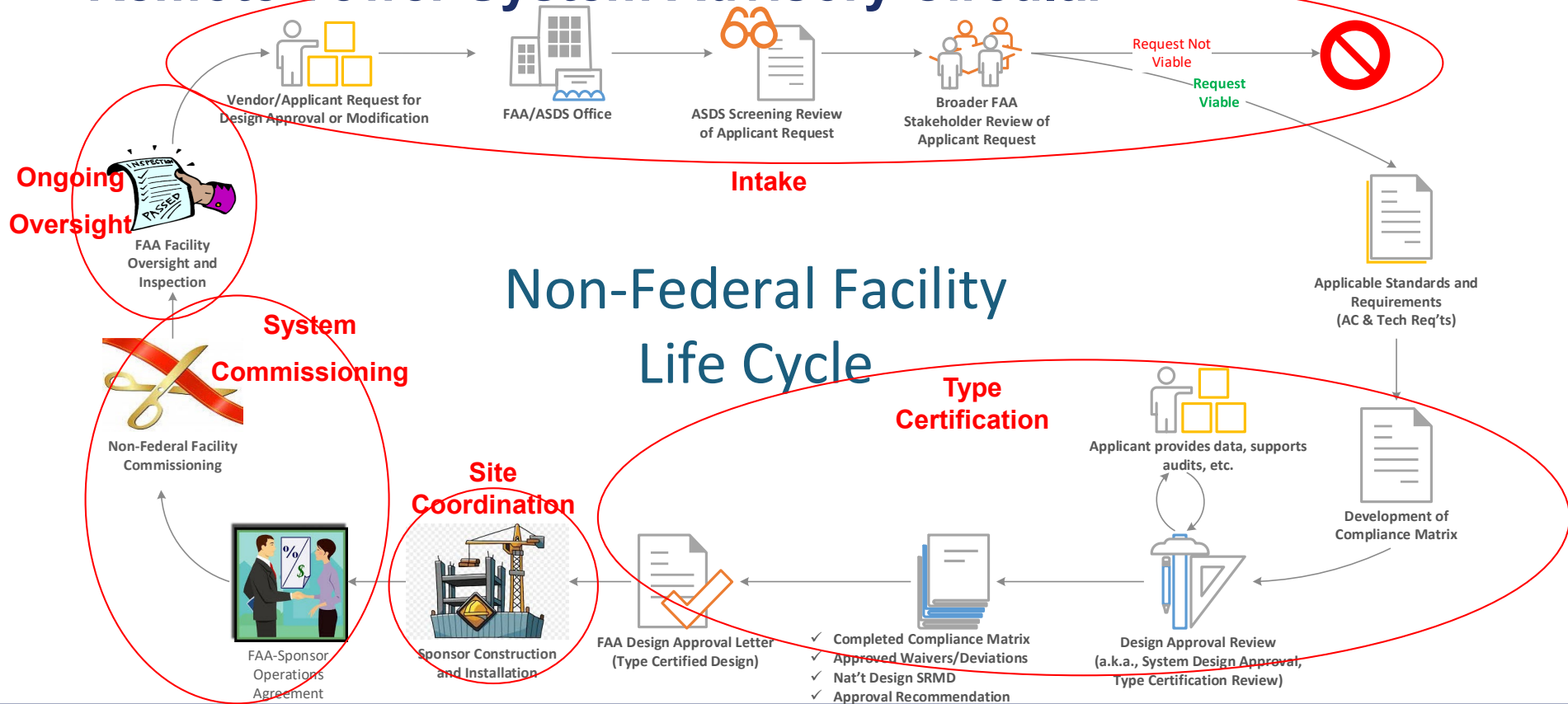
- **Primary Purpose of this AC**
  - Identify RT system approval requirements/standards
  - Identify the processes used to Type Certify RT systems
  - Identify the process used to commission a non-Federal RT facility
    - Note: Approval of the entire ATC facility is outside the scope of this document

- **Intended Audience**
  - Applies to all entities associated with the design, manufacture, procurement, installation, or maintenance of an RT system intended to enable Airport Traffic Control (ATC) services in Class D Airspace

Remote Tower System Advisory Circular

Non-Federal Facility Life Cycle

Intake
- Vendor/Applicant Request for Design Approval or Modification
- FAA/ASDS Office
- ASDS Screening Review of Applicant Request
- Broader FAA Stakeholder Review of Applicant Request
- Request Not Viable
- Request Viable

Applicable Standards and Requirements (AC & Tech Req'ts)

Type Certification
- Applicant provides data, supports audits, etc.
- Development of Compliance Matrix
- Design Approval Review (a.k.a., System Design Approval, Type Certification Review)
- Completed Compliance Matrix
- Approved Waivers/Deviations
- Nat'l Design SRMD
- Approval Recommendation
- FAA Design Approval Letter (Type Certified Design)

Site Coordination
- Sponsor Construction and Installation

System Commissioning
- Non-Federal Facility Commissioning
- FAA-Sponsor Operations Agreement

Ongoing Oversight
- FAA Facility Oversight and Inspection

Remote Tower System Advisory Circular

- **Primary Processes Described in the AC:**
  - Intake
    - Review of applicant request for system Type Certification
    - Transition (FAA Internal Planning & Scheduling)
  - Type Certification (Design Specific)
    - System Design Review
    - ATC Operational Assessment
  - Site Coordination
    - Coordination with non-Federal Program Implementation Manager (PIM)
    - Notice of construction alteration
  - Non-Federal System Commissioning (Site/Sponsor Specific)
    - Notice of construction
    - Equipment Siting, Installation, Verification, and Checkout
    - Commissioning Ground Inspections
    - Sponsor/FAA Operations and Maintenance Manual (OMM)
  - Post Commissioning Oversight
  - <u>Modifications to Approved non-Federal Systems</u>
    - Regression review of modifications to the previously approved design (e.g., h/w, s/w, and documentation)
    - Facility modification procedures
    - Return to service procedures

Remote Tower System Advisory Circular

- **Goals of Type Certification Process**
  - Verify compliance with the requirements identified in the *approval basis*
  - Define the design data that substantiates compliance
  - Ensure, to the degree possible, that the design will be viable in the NAS as a non-Federal facility
  - Ensure that the applicant has the production infrastructure to reliably reproduce and maintain the approved configuration
  - Document the accepted design configuration (hardware, software, and technical documentation)
  - Recommend regulatory approval of the reviewed design

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Remote Tower System Advisory Circular

- **Type Certification Approval Basis**
    - AC identifies or makes reference to the requirements that form the approval basis for RT systems:
        - Every "must" and "shall" in the referenced *Remote Tower (RT) Systems Minimum Functional and Performance Requirements for Non-Federal Applications (*a.k.a., Technical Requirements Document)
        - Compliance to process requirements and standards defined in the AC
    - Approval Basis will be captured in a Compliance Matrix to facilitate each Type Certification review project

Remote Tower System Advisory Circular

- **Type Certification – Key Review Activities**
  - Systems Engineering
    - Quality Assurance,
    - Configuration Management,
    - Requirements Management,
    - Sub-contractor management, etc.
  - System Safety Assessment
    - Applicant System Safety Documentation (e.g., FHA, PSSA, FMEA, etc.)
    - SAE/ARP-4754A and ARP-4761 used for reference and as industry best practice
  - Software Design Assurance
    - RTCA/DO-278A used for reference and as industry best practice
  - Complex Hardware Design Assurance
    - RTCA/DO-254 used for reference and as industry best practice

Remote Tower System Advisory Circular

- **Type Certification – Key Review Activities Continued**
  - System Level Verification
    - Verification of Applicant's System Level Requirements and Requirements Coverage
    - Traceability between RT Technical Requirements and Applicants System Level Requirements
  - Information System Security
    - Review of security requirements and verification against the security requirements defined in the technical requirements document
    - FAA security policy associated with non-Federal systems is under discussion. <u>Updates to the information system security review may occur.</u>

Remote Tower System Advisory Circular

- **Type Certification – Key Review Activities Continued**
  - Technical Documentation
    - Commercial Instruction Book (CIB)
    - Installation plans and procedures
    - Siting plans and procedures
    - Calibration procedures
    - Equipment manuals
  - Training
    - Development and Course Materials
      - Maintainer
      - ATC
  - Operational Evaluation
    - System Level Operational Evaluation
    - Air Traffic Control Evaluation

Remote Tower System Advisory Circular

- **AC Updates Under Discussion/Consideration**
  - Add sponsor requirements associated with the operation of an RT system
    - Site specific items (i.e., not system/design requirements) that are not covered in the Technical Requirements
  - Updates associated with ATC operational evaluation
  - Updates to appendices to create more standardized review processes
    - For example, some sections in Appendix A currently describe types of data that may be available for review but do not describe an overall review process and pass/fail criteria
  - Expand guidance on waiver/deviation request and approval processes

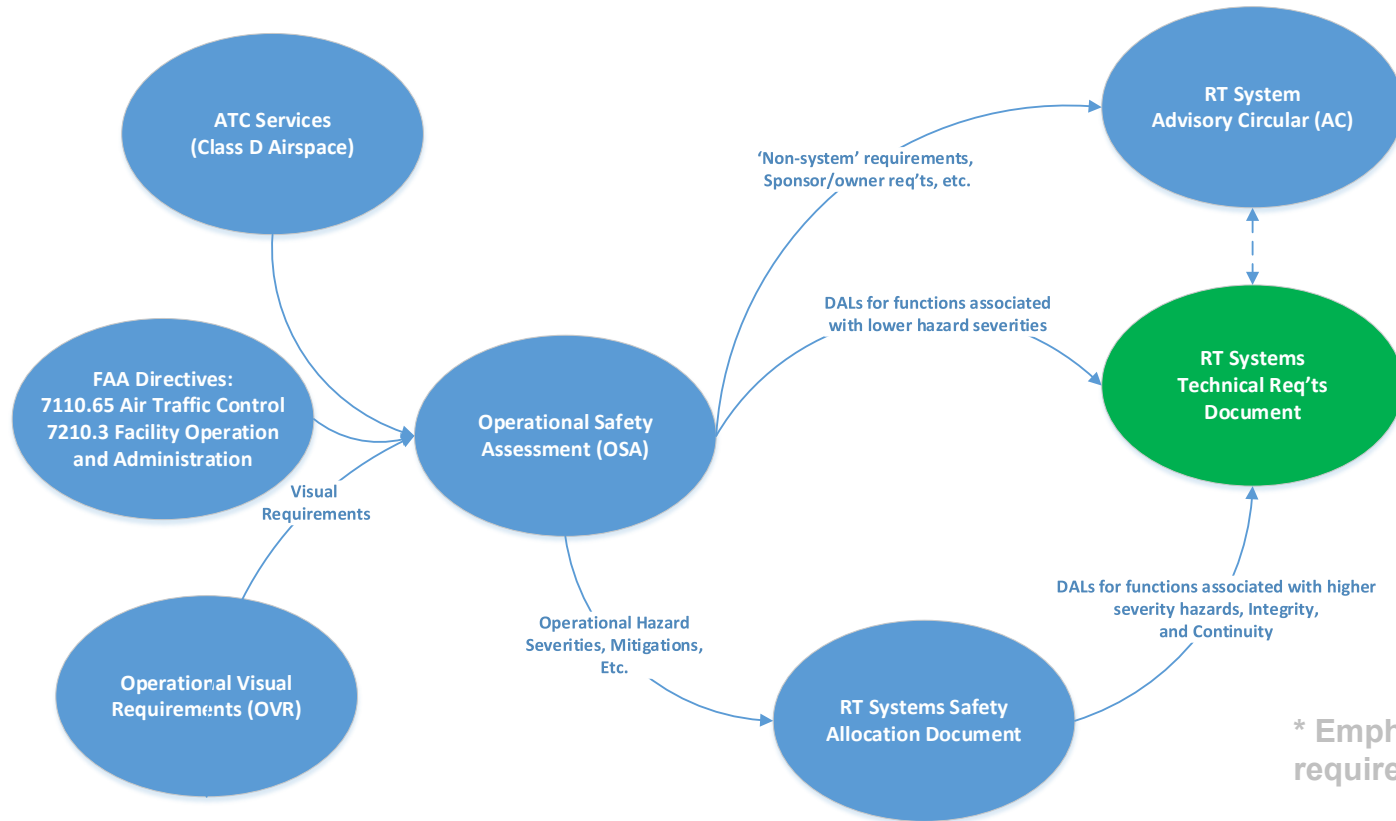# Remote Tower System Advisory Circular (AC)

Questions?

FAA Remote Tower
Technical Requirements Document

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Technical Requirements Document

- Technical Requirements Background:
  - No existing RT standards suitable for non-Federal approval
    - Leveraged existing documents to the degree possible (e.g., EUROCAE ED-240A)
  - Draft technical requirements were generated by internal FAA working groups from multiple LoBs and organizations
  - Intended to capture the minimum set of safety, performance, and functional requirements necessary for an RT system to be a viable non-Federal system in the NAS

Conceptual Path to RT Technical Requirements*

ATC Services
(Class D Airspace)

FAA Directives:
7110.65 Air Traffic Control
7210.3 Facility Operation
and Administration

Operational Visual
Requirements (OVR)

Visual
Requirements

Operational Safety
Assessment (OSA)

'Non-system' requirements,
Sponsor/owner req'ts, etc.

DALs for functions associated
with lower hazard severities

RT System
Advisory Circular (AC)

RT Systems
Technical Req'ts
Document

Operational Hazard
Severities, Mitigations,
Etc.

RT Systems Safety
Allocation Document

DALs for functions associated with higher
severity hazards, Integrity,
and Continuity

* Emphasis on safety
requirements path

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Safety Requirements Background

- **Operational Safety Assessment (OSA) developed to assess operational hazard severities associated with RT system failures and establish initial safety requirements**
- **OSA use case consistent with Pilot Program validation efforts**
  - Single runway/single airport
  - Point-to-Point network (i.e., "Closed Network")
  - Visual only (i.e., no additional surveillance)
  - Class D airspace

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Safety Requirements Background Continued

- **A safety allocation document was developed to determine acceptable RT safety requirements while considering the effectiveness of existing NAS controls/mitigations.**
  - A goal of apportioning the safety "credit" across the RT system and existing NAS controls/mitigations is to reduce the RT system design burden while adequately addressing the operational hazards.
  - This allocation document is still under development/review.
    - The Design Assurance Level (DAL), integrity, and continuity requirements in the RT Technical Requirements Document Draft v2 are consistent with the current draft of the RT System Safety Allocation Document.

Technical Requirements Document

- **Required Functions**
  - Required Visual Presentation (RVP)
  - Ambient Airfield Audio (AAA)
  - Data Recorder (DR)
  - Signal Light Gun (SLG)
  - Control Status Display (CSD)
  - Maintenance Data Terminal (MDT)
  - Binocular
- **Optional Function(s)**
  - Supplemental Visual Presentation (SVP)

Technical Requirements Document

- Technical Requirements Document Draft v2 Content
  - Functional Requirements
    - Examples:
      - Defines "Required Visual Presentation (RVP)"
      - Identifies the requirement for an RVP
      - Identifies functional requirements for the RVP
    - Provides guidance, considerations, and some requirements for optional functions
  - Performance Requirements
    - Examples:
      - States and Modes
      - Alerts and Alarms
      - Event Logging

Technical Requirements Document

- Technical Requirements Document Draft v2 Content Continued
  - RMA Requirements
    - Redundancy management
    - System availability references and notes with respect to RT systems provided in Appendix F

  - Physical Integration
    - Environmental Requirements
    - Lightning protection, grounding, bonding, and shielding requirements

  - Human Factors (HF)
    - Design requirements and considerations
      - HF guidance and recommendation material provided in Appendix D
    - Employee safety and health

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Technical Requirements Document

- Technical Requirements Document Draft v2 Content Continued
  - Security
    - Information Systems Security
      - System Access, Administration, Authentication, Alerting, Auditing, etc.
  - Safety
    - Design Assurance Levels for each function
    - Integrity
      - Probability of an undetected malfunction resulting in Hazardously Misleading Information (HMI)
    - Continuity
      - Probability of the loss of continuity of operation
      - Loss of continuity defined to be a critical failure resulting in the loss of the RVP and related sub-functions (e.g., loss of RVP control, loss of RVP monitoring capability, loss of RVP status, etc.)
  - Verification Requirement Test Matrix (VRTM)
    - Proposed verification methods for all requirements
      - Test, Demonstration, Inspection, and Analysis

Technical Requirements Document

- Technical Requirements Updates Under Consideration
  - Addition of a system availability requirement
  - Updates to information system security requirements
  - Verification Appendix
    - Identify an acceptable set of verification cases and procedures (e.g., test method(s)) for a critical subset of requirements
      - e.g., requirements that are deemed critical and/or requirements associated with non-trivial verification activities
  - Updates to requirements on optional functions
    - PTZ, visual tracking, IR cameras, etc.

Next Steps and Wrap Up

Next Steps

- **Participants are invited to submit comments and concerns against the draft AC and Technical Requirements documents by September 24, 2021**
  - Please use the distributed comments sheet, and if possible, consolidate comments into one sheet for your company
  - Early submittals are welcomed & encouraged
- **Comments will be discussed internally and responses prepared**
- **Individual virtual meetings will be scheduled with each company to discuss as needed**
- **Resulting updates to documents will be incorporated into the next version of the AC and Technical Requirements documents**
  - Goal: Next version of the Technical Requirements document will serve as the initial approval basis for type certification

Wrap-Up

- *Final Questions if Time Allows*

- **Thank you all for your participation!**

- **If you have questions about submitting comments, e-mail Non-Federal-Program@faa.gov**
  - You will receive a response within 3 working days.

Closing Remarks

Backup Slides

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Remote Tower Camera Visibility Research

- **Motivation**: Set criteria to assess remote tower camera visibility during siting phase, building on FAA tower siting criteria *(FAA Order 6480.4)*
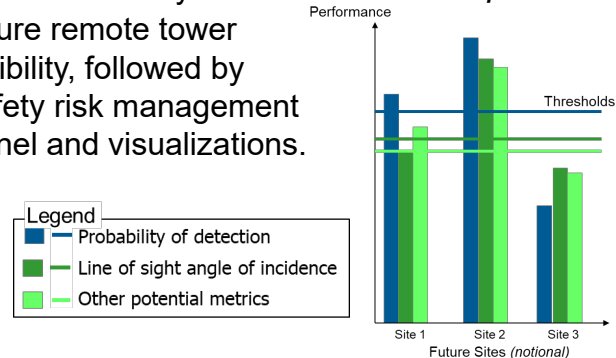
- *Representative Remote Tower Development Phases*

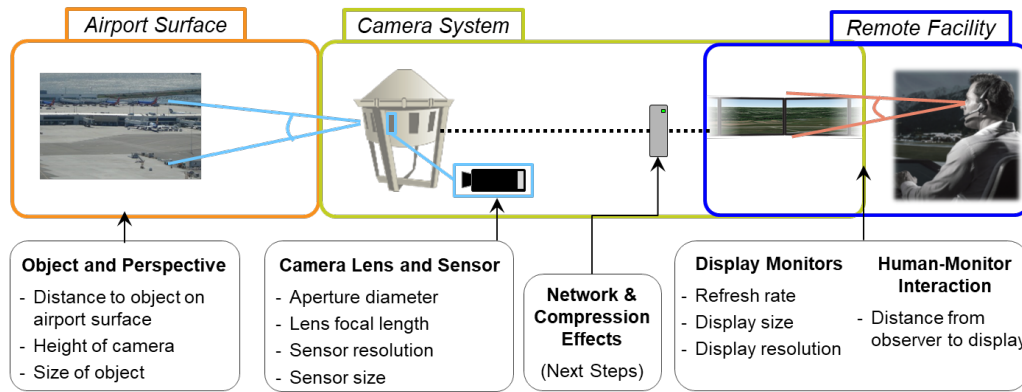Design → Installation → Test → Operation

- Camera visibility research

- **Vision**: Initially assess future remote tower visibility, followed by safety risk management panel and visualizations.

- *Notional representation of camera performance*

Performance

Thresholds

Legend
- Probability of detection
- Line of sight angle of incidence
- Other potential metrics

Site 1   Site 2   Site 3

Future Sites *(notional)*

- **Scope of the Video Camera System**

Airport Surface   *Camera System*   *Remote Facility*

Object and Perspective
- Distance to object on airport surface
- Height of camera
- Size of object

Camera Lens and Sensor
- Aperture diameter
- Lens focal length
- Sensor resolution
- Sensor size

Network & Compression Effects

(Next Steps)

Display Monitors
- Refresh rate
- Display size
- Display resolution

Human-Monitor Interaction
- Distance from observer to display

Camera Visibility Research: Scope

Visual Panoramic and Pan-Tilt-Zoom Views

Visibility Performance Analysis	Purpose *(ref FO 6480.4 App D)*	Existing Minimum Criteria for Towers *(ref FO 6480.4 sec 2-4)*
Detection Probability	Assess an observers' probability of detection of an object on the airport surface as a function of observation range, tower height, and atmospheric and surface conditions *(i.e., observer knows something is present but may not recognize or identify the object)*	Detection probability for front view of caravan **≥ 95.5%**
Line of Sight Angle of Incidence	Assess an observer's viewing perspective of the airport surface key points *(e.g., furthermost runway threshold, airport movement areas, taxiways and critical non-movement areas)*	Line of sight angle of incidence **≥ 0.80˚**
Two-Point Lateral Discrimination	Quantify the impact of tower height on the ability to laterally separate two critical points of the airport surface operations.	the observer's viewing angle between 2 points by **≥ 0.13˚** (8 minutes)
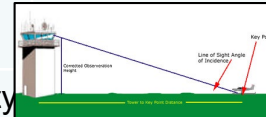
Remote Tower Advisory Circular (AC)

- **General Awareness -- Majority of processes described in the AC have been used in other non-Federal system approvals for complex safety critical systems; however,**
  - First non-Federal ATC Tower related system
  - Highly integrated with existing ATC directives, processes, and procedures
  - AC and key documents referenced in the AC (e.g., OVRs and Technical Requirements) continue to be vetted across multiple FAA organizations