U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, DC 20591

August 25, 2023

The Honorable Patty Murray
Chair, Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Chair Murray:

Enclosed is the Federal Aviation Administration's (FAA) Report to Congress: Plan and Schedule for System Design Approval of Remote Tower Systems.

The Joint Explanatory Statement accompanying the Consolidated Appropriations Act, 2022 requests the FAA to submit a report detailing the plan, schedule, and challenges for System Design Approval of remote tower systems. House Report 117-99 requests the FAA to report on any delays in meeting the calendar year 2021 deadline for establishing a remote tower certification process.

An identical letter has been sent to the Vice Chair of the Senate Committee on Appropriations and the Chairwoman and Ranking member of the House Committee on Appropriations.

Sincerely,

Polly Trottenberg
Acting Administrator

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, DC 20591

August 25, 2023

The Honorable Susan Collins
Vice Chair, Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Vice Chair Collins:

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800 Independence Ave., S.W.
Washington, DC 20591

August 25, 2023

The Honorable Kay Granger
Chairwoman, Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Chairwoman Granger:

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800 Independence Ave., S.W.
Washington, DC 20591

August 25, 2023

The Honorable Rosa L. DeLauro
Ranking Member, Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Ranking Member DeLauro:

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of Transportation
Federal Aviation
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Report to Congress:
Plan and Schedule for System Design Approval of Remote Tower Systems

INTRODUCTION

Section 161 of the FAA Reauthorization Act of 2018[1] (the Act) directs the Federal Aviation Administration (FAA) to establish a remote tower pilot program focused on concept validation in order to evaluate the capabilities and benefits of remote towers for the National Airspace System (NAS) and create a clear process for the safety and operational certification of the remote towers. The Act defines a remote tower as a remotely operated air navigation facility, including all necessary system components, that provides the functions and capabilities of an air traffic control tower whereby air traffic services are provided to operators at an airport from a location that may not be on or near the airport.[2]

As required by the Act, the FAA established a Remote Tower Pilot Program at two public-use airports in Leesburg, Virginia, and Fort Collins, Colorado. The airport in Leesburg, Virginia, Leesburg Executive Airport (JYO), is using the Saab Sensis Corporation (Saab) remote tower system, while the airport in Fort Collins, Colorado, Northern Colorado Regional Airport (FNL), is using the Searidge Technologies remote tower system. In addition, as required by the Act, the FAA has begun work on the required process for safety and operational certification of remote tower systems.

This report addresses two requests accompanying the Transportation, Housing and Urban Development, and Related Agencies Appropriations Act of 2022 (Consolidated Appropriations Act, 2022).[3] The first requests the FAA to report on any delays in meeting the calendar year 2021 deadline to establish a remote tower certification process. Specifically, House Report 117-99 accompanying the Consolidated Appropriations Act, 2022 states:

> *Remote towers. Consistent with section 161 of the FAA Reauthorization Act of 2018, the Committee encourages the FAA to use remote tower technology as a means to enhance safety, reduce costs, and expand air traffic control services at rural and small community airports. The FAA anticipates completing the specifications for the certification of a remote tower by the end of calendar year 2021; the FAA is directed to report to the House and Senate Committees on Appropriations about any delays in meeting this deadline as soon as they become known. Issuance of the certification will depend on the strength of the application, quality of data presented, and the safety benefit provided.*

The second requests that the FAA submit a report detailing the plan, schedule, and challenges for System Design Approval (SDA)[4] of remote tower systems. The Joint Explanatory Statement accompanying the Consolidated Appropriations Act of 2022 states:

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[1] Public Law 115-254.

[2] § 161(a)(9)(B) of the Act.

[3] Public Law 117-103.

[4] The FAA has decided to use the term "System Design Approval" (SDA) instead of the term "type certification" used in the Consolidated Appropriations Act, 2022 to avoid confusion with the FAA Aviation Safety organization's aircraft type certification process.

Remote towers. The agreement includes $4,900,000 for remote towers, which will be used to fund contract controllers for type certification at Leesburg, to complete the active testing phase of the operational evaluation at Fort Collins, and to begin the validation and verification at Fort Collins. The agreement directs the FAA to submit a plan and schedule for type certification of remote towers systems no later than 90 days after the enactment of this act. The plan and schedule should focus on accelerating type certification for the safe operation of remote towers and identify any challenges the agency faces in doing so.

This report provides a status update on the FAA's efforts to develop specifications and minimum standards for the SDA of remote tower systems. The report also details the FAA's plan and process for SDA of remote tower systems. The report provides a notional schedule for the SDA, the means by which the FAA attempted to accelerate this process for the Saab system installed at JYO, and the challenges the FAA faces. Finally, due to the extensive coordination required to finalize this report, the report provides key updates that impact the remote tower program and vendors' status and acceleration efforts.

Status of Remote Tower Demonstration of Feasibility

From 2016 to 2022, the Remote Tower Pilot Program conducted extensive air traffic operational evaluations at JYO and FNL. This work included setting up the Searidge Technologies remote tower system at Fort Collins, Colorado, the development of Operational Visual Requirements (OVRs) in order to assess the remote tower systems, and the development of testing plans, including both passive and active phases of air traffic control. In order to perform the testing at both JYO and FNL, multiple Safety Risk Management panels were required. In September 2021, the Remote Tower Pilot Program deemed the remote tower system at JYO as operationally viable to provide the visual information needed for the delivery of Air Traffic Control services at Visual Flight Rules (VFR) airports with a single runway length of 5,500 feet or less and in Class D airspace. This decision by the FAA conveys that the system installed at JYO functions under routine conditions.

Status of Remote Tower Specifications for SDA

The Remote Tower Pilot Program concept validation, effort began without the FAA or an external standards body defining formal technical or operational requirements.[5] To field remote towers as non-federally owned and operated systems successfully, the FAA required a set of system-generic minimum technical requirements that would ensure viability and safety of use at all airports considered within the scope for the application. Thus, the FAA's initial SDA effort focused on defining a minimum set of functional, performance, and safety requirements for remote tower system designs. Once the Remote Tower Pilot Program developed the OVRs, the FAA convened a Safety Risk Management Panel to develop a design-agnostic Operational Safety Assessment (OSA). The OSA process identifies a minimum set of system functions,

[5] European Organisation for Civil Aviation Equipment ED-240, *Minimum Aviation System Performance Standard for Remote Tower Optical Systems*, guidance was not sufficient for the use cases in the United States because it relies on a distance requirement to be produced for each airport and does not specify siting criteria, which must be established by the manufacturer of the remote tower system. ED-240 also left many requirements and parameters to the discretion of individual Air Navigation Service Providers.

defines operational services and environments, identifies functional hazards, and assesses the hazard's associated operational severities. Safety requirements and objectives are then defined to ensure that operational risks are controlled to acceptable levels (i.e., the likelihood of a hazardous event occurring is commensurate with the severity of the hazardous affect).
The FAA then gathered internal stakeholders from multiple Lines of Business to develop the *Remote Tower Systems Minimum Functional and Performance Requirements for Non-Federal Applications* (hereafter referred to as *Technical Requirements*), which include the safety requirements and objectives identified in the OSA. The FAA also developed a draft Advisory Circular (AC), *Remote Tower Systems for Non-Federal Applications,* detailing the process for achieving an SDA. These two documents apply to applications for any remote tower at single-runway airports in Class D airspace.

In February 2022, the FAA released the *Technical Requirements* for the SDA of a remote tower system and the Remote Tower AC to potential vendors. The Remote Tower AC and *Technical Requirements* currently are the primary approval basis for SDA. The Remote Tower AC leverages existing aviation industry best-practice standards associated with development assurance, software design assurance, and complex hardware design assurance. FAA Safety Management System guidelines recognize these standards as acceptable means of compliance for new Communication, Navigation, Surveillance, and Air Traffic Management (CNS/ATM) systems. The completion of the draft Remote Tower AC and Technical Requirements fulfills the requirement in House Report 117-99.

Figure 1 is a timeline of the FAA activities in developing the specifications for a remote tower system.

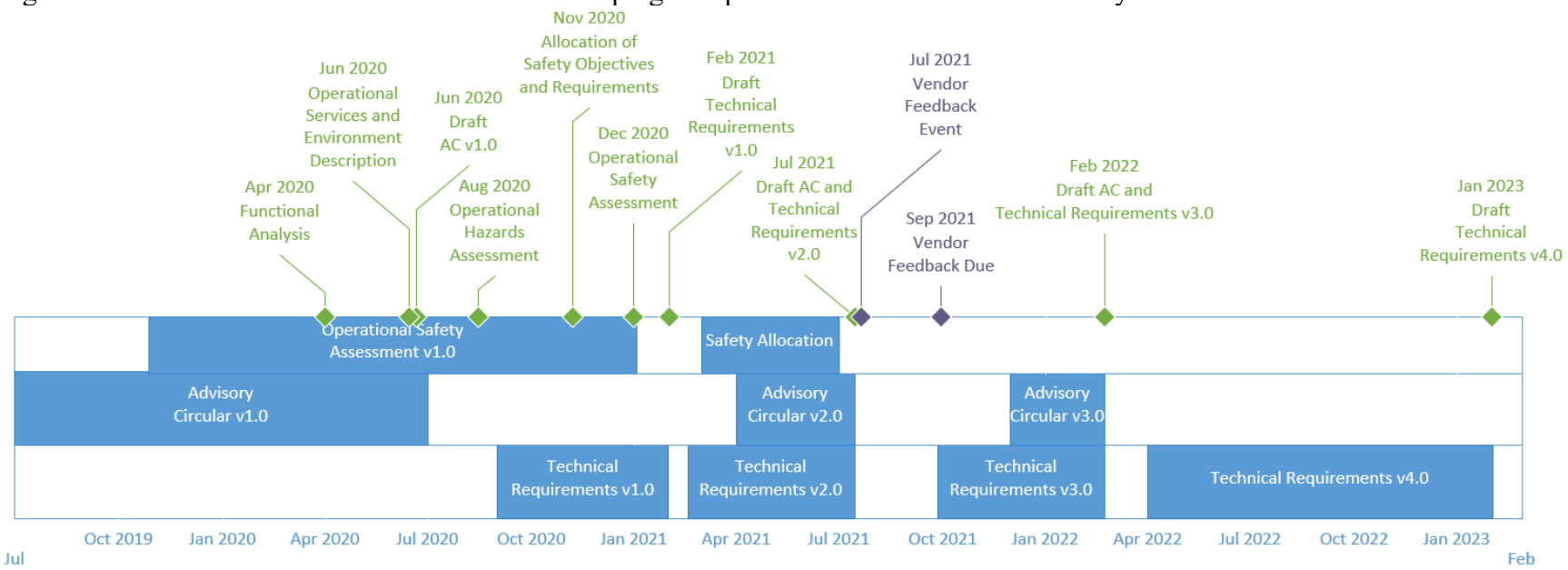

Figure 1 Remote Tower Specification Timeline

As the Remote Tower Pilot Program progresses and investigates more advanced use cases, such as multiple runways or supplemental surveillance, for remote tower systems, the FAA will reconvene the OSA panel to reassess the severity of existing hazards and assess any additional functionality and associated hazards. The OSA and *Technical Requirements* must be updated accordingly for each new use case.

Update on SDA Process

While the selection criteria for the Remote Tower Pilot Program focus on the airport and environment, the SDA process is applied to a vendor's remote tower system design. The FAA plans to validate the draft Remote Tower AC using the vendors that are participating in the Remote Tower Pilot Program (applicants). Because each applicant's remote tower system design is different, the FAA has identified key content, as shown in Table 1, which applicants must deliver to ensure their system design meets or exceeds the top-level safety requirements and objectives.

Plan

The notional schedule flow in Figure 2 shows the overall SDA process flow, which the FAA must apply for each applicant. The schedules are contingent on receiving artifacts addressing the key content from each applicant. The FAA must review and approve every artifact, per FAA standards, to ensure the safe operation of the remote tower system. Final schedules for each applicant will depend on the timeliness and robustness of their deliveries.

Accelerated SDA Plans

In order to accelerate the SDA process for Saab, the FAA and Saab are concentrating on key risk areas first. The FAA and Saab have agreed that these key risk areas include integrity and continuity, software design assurance, information system security, general equipment requirements, and training. The FAA and Saab selected these areas based on safety, cost, and schedule criteria. The FAA and Saab are jointly developing a tailored schedule to review the documentation that will show compliance with these areas. Once Saab addresses these key risk areas adequately, the FAA will continue to review the remainder of the required artifacts per the SDA process. Although the goal will be to accelerate the SDA process, the FAA must continue to verify the quality of the data provided.

To expedite the SDA process for future applicants, including Searidge Technologies, the FAA is actively working to collect key artifacts earlier during pilot program operational testing. This will allow the FAA to provide an initial assessment of the feasibility of an applicant completing SDA earlier in the process, as well as feedback to applicants during the pilot program's operational viability testing. This early coordination should reduce the amount of rework that has to occur in key SDA areas before formal FAA acceptance and non-federal commissioning of these systems.

SCHEDULE

Figure 2 illustrates a notional schedule, based on the SDA process, per the draft AC, *Remote Tower Systems for Non-Federal Applications.* Figure 2 shows required applicant artifact deliveries, identified as blue diamonds, which initiate the FAA activities depicted in green. The following pages include additional information regarding the anticipated applicant SDA artifacts. This notional schedule represents the necessary activities for an applicant to achieve an SDA and does not represent the Site Commissioning tasks that will be performed for each airport. There is a large amount of variability in any proposed schedule due to the FAA's lack of control with respect to the quality and timeliness of applicant deliverables.

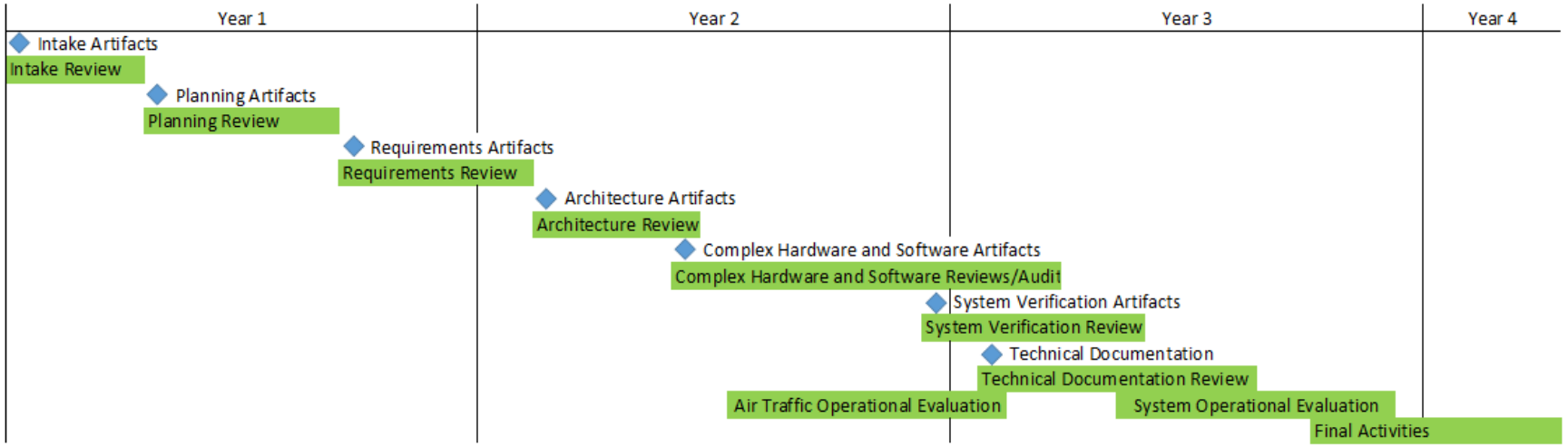

Figure 2 Notional Schedule

The contents of the applicant artifact deliveries are held to FAA quality standards to ensure the safe operation of the remote tower system. Specific artifacts can vary from applicant to applicant based on individual company practices and processes. Table 1 below identifies typical SDA submittals/artifacts.

Table 1 SDA Artifacts

Intake Artifacts	Systems Requirement Specification
	Initial System Approval Plan
	Concept of Operations
	Initial Functional Hazard Assessment
	Preliminary Assessment of Operational Feasibility
Planning Artifacts	System Approval Plan
	Systems Engineering Management Plan
	Integral Process Plans
	Requirements Validation and Verification Plans
	Waiver and Deviation Requests
	System Characterization Document
Requirements Artifacts	Design Documentation
	Requirements Definition
	System Security Plan
	Functional Hazard Assessment
	Compliance Matrix
Architecture Artifacts	Preliminary System Safety Assessment
	Requirements Documentation
	Sub-system Requirements
	Ancillary Equipment Requirements
Complex Hardware and Software Artifacts	Complex Hardware/Software Plans and Standards
	Complex Hardware/Software Requirements
	Complex Hardware/Software Design/Validation, and Verification
	Hardware/Software Accomplishment Summary
System Verification Artifacts	Verification Cases and Procedures
	Verification Results
	Verification Compliance Matrix
	System Safety Assessment
	System Approval Summary Report
Technical Documentation	Commercial Instruction Book
	Air Traffic Control End-User Guide/Manual
	System Siting Plan
	System Characterization Document
	Maintainer Training
	Air Traffic Controller Training

As indicated above, the FAA and Saab are expediting the Saab SDA process by focusing on key risk areas first. Figure 3 represents the FAA's accelerated tasks based on an assumed artifact delivery schedule. Once Saab has addressed the key risk areas, there will be additional reviews per the standard SDA process. FAA subject matter experts have met with Saab on multiple occasions to discuss the details of Saab's approach to their safety process and artifacts. The artifacts delivered for the Integrity and Continuity Key Risk Area (Failure Modes Effect and Analysis [FMEA], System Safety Plan, Fault Tree Analysis [FTA], Systems Engineering Management Plan [SEMP], Zonal Safety Analysis [ZSA], Particular Risk Analysis [PRA], and Common Mode Analysis [CMA]) are in support of the System Safety Assessment. Reviewing these key analyses earlier in the process will minimize the chance of a ripple effect of rework later in the SDA review, as later deliverables will build upon these documents. The FAA's best-case estimate is an SDA no earlier than calendar year 2024, assuming that the quality of the deliverables presented meets the FAA's standards and that they are submitted in a timely manner.

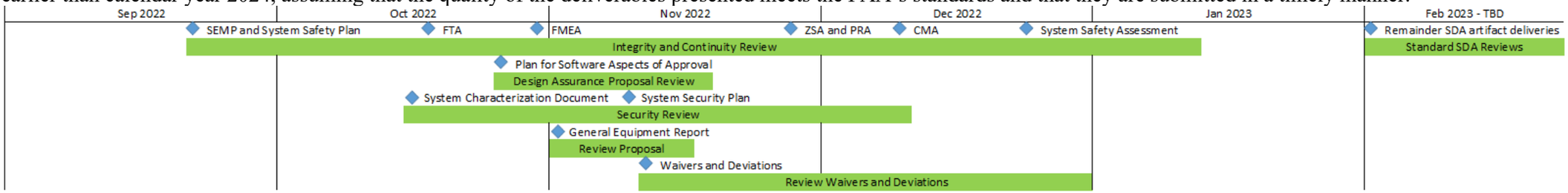

Figure 3 Near-Term Saab Schedule

CHALLENGES

The FAA faces numerous challenges in completing the SDA of non-federal remote tower systems. Some of these challenges are inherent to the challenges associated with completing the SDA of these systems, while others are applicant-specific.

- Remote tower programmatic challenges include the following:
  - Challenge: As there were no requirements appropriate for the FAA's use case available at the start of the Remote Tower Pilot Program, existing systems, not approved by the FAA, were used to investigate the viability of the overall remote tower concept, which resulted in an Operational Viability Decision. A positive Operational Viability Decision conveys that the system is useable in typical conditions by Air Traffic Control.
    - Consequence: The applicant's design must still undergo a more in-depth analysis to determine its integrity and robustness before the FAA can issue an SDA. Additional work must be done to confirm that the underlying design meets the minimum functional, performance, and safety requirements before the system can be commissioned into the NAS fully or implemented at additional sites.
  - Challenge: Applicants must show compliance with the *Technical Requirements;* however, these requirements were not available when applicants' systems were under development.
    - Consequence: This challenge has created gaps between system capabilities and minimum requirements. The FAA must, on a case-by-case basis, determine whether these gaps are acceptable. Applicants will need to address unacceptable gaps prior to the FAA issuing an SDA. The associated redesign and documentation updates will lead to additional costs to the vendor and delays in the SDA schedule.
  - Challenge: The use case and environment in which the systems are used internationally do not align with the use case for the United States. Internationally, many remote tower systems are used at low-use airports with only scheduled Instrument Flight Rules traffic and are fielded with certified radar displays. In contrast, the FAA intends to approve these systems as standalone with no requirement for radar surveillance.
    - Consequence: The FAA's intended use case increases the criticality of the out-the-window view provided by the remote tower system. In order to achieve SDA, applicants will need to demonstrate compliance with stricter requirements.
  - Challenge: The Remote Tower Pilot Program's first site at JYO, and its second site at FNL, represent different use cases (e.g., one versus two runways).
    - Consequence: This challenge will require updates to the OSA and possibly the *Technical Requirements,* causing delays to applicants as the FAA identifies any additional safety hazards or requirements based on the new use case.
  - Challenge: This is the first non-federal ATM system being considered for SDA.
    - Consequence: Policies and directives require updates to allow for seamless remote tower operations in the NAS.
  - Challenge: SDA reviews are work-intensive and require special expertise in several areas. Additional applicants will strain the funds and resource allocations for the SDA process.
    - Consequence: Two or more applicants cannot be accommodated at once without schedules for all being extended.

- Saab-specific challenges include the following:
  - Challenge: Saab did not follow a typical development process for a CNS/ATM system (i.e., it used an *ad hoc* development process).
    - Consequence: Numerous required development artifacts (e.g., requirements for all commercial off-the-shelf components) do not exist and are being reverse engineered to show compliance. This reverse engineering and the associated documentation updates will lead to additional costs for Saab.
  - Challenge: Saab has not yet provided sufficient data to satisfy a safety case.
    - Consequence: The FAA must ensure the integrity of systems operating in the NAS. If Saab is unable to prove the safety of its system design, the FAA cannot approve that design for use in the NAS.
  - Challenge: While the Saab remote tower system was not developed using a formal development standard, Saab has reported that it has been audited against some European standards and processes—which differ from United States standards—and was found to be compliant. However, Saab has not provided data to enable the FAA to substantiate these claims.
    - Consequence: The FAA cannot leverage work done in other countries without data showing what baseline and use case was approved and to what degree the system was reviewed.
  - Challenge: The FAA has agreed to consider the use of some European standards and processes in lieu of traditional FAA standards.
    - Consequence: This challenge will require additional effort by the FAA and Saab to determine traceability between these standards. This additional effort extends the SDA timeline.

April 2023 Update

Due to the extensive coordination required to finalize this report, significant time has elapsed since its initial preparation. This section provides key updates that impact the remote tower program and vendors' status and acceleration efforts.

In July 2022, Saab began the delivery of their SDA documentation with a Systems Engineering Management Plan, System Safety Plan, and Plan for Software Aspects of Approval. The FAA reviewed those items and submitted numerous comments addressing deficiencies back within 30 business days. The FAA and Saab met to discuss the comments in September – December 2022. On February 7, 2023 Saab Sensis notified the FAA of the withdrawal of its request for SDA for the Remote Tower system installed at JYO. With Saab's decision to cease pursuit of SDA, the FAA cannot assure the system's hardware and software will not present controllers with false or misleading information that could lead to safety events in the NAS. FAA has determined that continued use of this unapproved/prototype system, which is no longer in the SDA process, poses an unacceptable level of risk to all users. FAA has developed a plan to safely cease Remote Tower services at JYO.

The Remote Tower Pilot Program has issued an official stop work order for Searidge Technologies in testing their remote tower system at FNL due to significant deficiencies in the system's capabilities, as noted by air traffic evaluators during Phase I testing. The FAA requested a plan of action from Searidge, which includes Searidge making system updates to

address the deficiencies identified and delivering key artifacts to allow the FAA to provide an initial assessment of the feasibility of the vendor completing SDA. Completion of these items would allow the evaluation of the Searidge system to restart at FNL.

The evaluation of a remote tower system at individual airports has resulted in operational sites relying on remote tower systems that have not been formally approved by the FAA for the provision of ATC services. Additionally, the testing at airports is limited by the specific operational factors, environment, and complexity of those airports (i.e., the system performance envelope may not be adequately quantified and verified). In order to avoid this in the future, the FAA has decided to no longer select individual airport "pilot" sites to evaluate vendor systems. The FAA is now requiring future applicants' systems to be tested at the William J. Hughes Technical Center (WJHTC) in Atlantic City, N.J. The FAA is establishing this testbed to accelerate the timeline in meeting the goals of the Act. This new approach will allow the FAA to provide approved options in the remote tower marketplace and reduce risk to FAA and airport sponsors in the case the vendor system cannot meet FAA standards.

The Remote Tower Pilot Program has begun this new approach using the remote tower system developed by Frequentis in collaboration with Raytheon Intelligence and Space. As noted previously, the FAA is also actively working to collect key SDA artifacts from the vendor prior to installation and testing to ensure that they are adequately prepared to complete a system approval process.

CONCLUSION

The FAA has made significant progress toward defining the process and requirements necessary to support an SDA of non-federal remote tower systems. Initial work toward this goal required the FAA to establish the OSA, *Technical Requirements*, and the draft AC, *Remote Tower Systems for Non-Federal Applications*. Substantial work on SDA projects for individual applicants could not begin until this work was complete. The FAA also has made significant progress in establishing the process for the Air Traffic Organization to evaluate candidate remote tower systems for operational suitability during the System Evaluation phase of the SDA process. The FAA attempted to move forward as expeditiously as possible with the initial Saab SDA project; however, numerous challenges were encountered. Saab ultimately identified that pursuit of SDA for the system installed at JYO was not worth the investment it would require of them, due to the lack of key system documentation and artifacts that did not exist. The FAA is also moving forward with early reviews of key documentation from other Remote Tower Pilot Program applicants to expedite future SDA projects. When feasible, the FAA will accelerate work while maintaining the Agency's commitment to ensuring that these systems are safe for use in the NAS.