



# Federal Aviation Administration

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## Memorandum

Date:

To: Teri L. Bristol, Chief Operating Officer, Air Traffic Organization, AJO-1

From: Jeffrey U. Vincent, Vice President, Air Traffic Services, AJT-0

Subject: Operational Viability Decision for Saab, Inc., Remote Tower System

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This memorandum provides Air Traffic Services' (AJT) decision regarding the Air Traffic Control (ATC) services that Air Traffic Control Specialists (ATCS) may provide using the Remote Tower (RT) System currently installed at Leesburg Executive Airport (JYO) in Leesburg, Virginia. AJT's decision is limited by the scope of the operational viability, for the ATCS, of the Saab, Inc., RT System's configuration as evaluated at JYO.

This decision does not imply Type Certification or acceptance into the Federal Aviation Administration Contract Tower (FCT) Program. A decision for acceptance into the FCT Program requires (1) the JYO airport sponsor to apply with a Type Certified RT System; and, (2) the completion of a Benefit/Cost (B/C) Ratio analysis. To be deemed fully operationally suitable, as with other like National Airspace Systems tools, final certification of this RT System must still be proven to meet technical requirements, which are being finalized by Technical Operations (AJW-1).

Since 2016, the Federal Aviation Administration (FAA) has conducted extensive air traffic operational evaluations of the Saab, Inc., RT System at JYO. This system is intended to replace the out-the-window (OTW) view of a traditional brick-and-mortar tower with cameras and visual presentation displays for the provision of certain ATC services. JYO ATCSs provide services using the information presented by the RT System in conjunction with existing minimum equipment outlined in AC 90-93B, *Operating Procedures for Airport Traffic Control Towers (ATCT) that are not Operated by, or Under Contract with, the United States (Non-Federal)*, and FAA Order JO 7210.78, Appendix A., *FAA Contract Tower (FCT) New Start and Replacement Tower Process*.

During the air traffic operational evaluations of the Saab, Inc., RT System, data was collected on the capability of ATCSs to use the visual information presented by the RT System to provide operational ATC services applicable to Class D airspace as outlined in FAA Order JO 7110.65, *Air Traffic Control*. All evaluations were conducted with a "visual only" RT System that does not incorporate surveillance information (e.g., radar data). Initial evaluations focused on

assessing the RT System's impact on ATCSs' visual acuity and depth perception. Later evaluation phases focused on ATCSs' ability to provide ATC services using the RT System in a single-runway airport environment in Class D airspace.

Throughout the evaluation phases, the FAA convened more than a dozen Safety Risk Management (SRM) assessments in sequence with the progression of the phased evaluations. The JYO Concept of Operations (ConOps) SRM Panel assessed end-state RT operations at JYO and verified two medium-risk hazards are associated with use of the RT System for the provision of spacing and sequencing services during airborne arrival/arrival operations and the provision of spacing and sequencing services on the movement area. The Site-Specific Standard Operating Procedures (SSOP) (listed in Attachment 1) were developed and implemented in June 2018 to mitigate these hazards at JYO. The final Validation & Verification (V&V) period confirmed the residual risk level associated with the use of the SSOPs as safety controls. All safety performance targets have been met through all periods of operational use of the Saab, Inc., RT System for the provision of ATC services at JYO.

AJT determined that the Saab, Inc. RT System installed at JYO, under its current configuration, is operationally viable to provide the visual information needed for the provision of ATC services, and may only be used without supplemental surveillance tools (e.g., radar data) at airport locations that meet the following criteria<sup>1</sup>:

1. Single runway with dimensions of 5,500 x 100 feet or less.
2. Class D airspace (locations currently Class E or G may only become Class D).

AJT may still require site-specific air traffic operational evaluations of the Saab, Inc., RT System at airport locations (outside of JYO) that meet the aforementioned criteria. Additionally, consideration may be given to traffic volume and complexity factors. Conversely, changes to the RT System, traffic volume, or complexity may require a revisit of viability.

ATCSs can provide the Class D airspace ATC services listed in the FAA Order JO 7110.65, *Application Overview*, (listed in Attachment 2) using the Saab, Inc., RT System in accordance with, and in compliance with, existing guidance in the following publications where applicable:

- FAA Order JO 7110.65, *Air Traffic Control*
- FAA Order JO 7210.3, *Facility Operation and Administration*
- Additional hazard-specific safety controls contained in the JYO RT SSOPs (listed in Attachment 1). These SSOPs must remain in place during the provision of ATC services using the Saab Inc., RT System.

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<sup>1</sup> AJT is evaluating the requirement for surveillance tools for use in remote tower sites.

The ATC separation services authorized for use by the Saab, Inc., RT System are listed below:

- Same runway separation services in accordance with FAA Order JO 7110.65, *Air Traffic Control*, Paragraphs 3-9-6a1, 2, 3, and 5<sup>2</sup>; Paragraph 3-9-6b; Paragraphs 3-10-3a1; Paragraphs 3-10-3a2(a) and (b); and Paragraph 3-10-3a3<sup>3</sup>.
- Helicopter separation services in accordance with FAA Order JO 7110.65, Paragraphs 3-11-3 and Paragraphs 3-11-4.

ATC services not authorized for use by the Saab, Inc., RT System are listed below:

- Tower-applied visual separation, as outlined in FAA JO 7110.65, Paragraph 7-2-1.
- Opposite Direction Operations (ODO), as outlined in FAA JO 7210.3, Paragraph 2-1-34.
- Line Up And Wait (LUAW), as outlined in FAA JO 7110.65, Paragraph 3-9-4.

The ATCSs using the RT System to provide ATC services must hold a Control Tower Operator (CTO) Certificate and adhere to the same ATC procedures in use for traditional ATCTs. These include, but are not limited to, procedures described in FAA Order JO 7110.65, FAA Order JO 7210.3, Letters of Agreement (LOA) and locally developed Standard Operating Procedures (SOP). In addition, ATCSs must receive training for the RT System and associated failure mode responses (as described in the JYO SOP), in accordance with FAA Order JO 3120.4, *Air Traffic Technical Training*.

The coordinating reference documents are attached. If you have any questions or need further information, please contact Nate Shumacker, Manager, Technical Advisory Group, North Team, AJT-2210, at [Nathaniel.Shumacker@faa.gov](mailto:Nathaniel.Shumacker@faa.gov).

#### 4 Attachments

JYO RT System Site-Specific Standard Operating Procedures

Leesburg Executive Airport Remote Tower Project FAA Order JO 7110.65 Application Overview, Version 1.0

Leesburg Executive Airport Remote Tower Project Air Traffic Operational Evaluations Overview, Version 1.0

Leesburg Executive Airport Remote Tower Project Safety Risk Management Overview, Version 1.0

cc:

Pamela Whitley, Assistant Administrator for NextGen, ANG

Glen Martin, Vice President, Safety and Technical Training, AJI-0

Jeffrey Planty, Vice President, Technical Operations, AJW-0

Angela McCullough, Vice President, Mission Support Services, AJV

Michael J. O'Donnell, Executive Director, Air Traffic Safety Oversight Service, AOV-1

<sup>2</sup> Tower-applied visual separation as outlined in FAA JO 7110.65, Paragraph 7-2-1 is not authorized. Pilot-applied visual separation as described in FAA JO 7110.65, Paragraph 7-2-1 is authorized if applicable.

<sup>3</sup> Tower-applied visual separation as outlined in FAA JO 7110.65, Paragraph 7-2-1 is not authorized. Pilot-applied visual separation as described in FAA JO 7110.65, Paragraph 7-2-1 is authorized if applicable.



**FAA**

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

# **Leesburg Executive Airport Remote Tower Project**

## ***FAA JO 7110.65 Application Overview***

*Version No. 1.0*

*Document Date: September 13, 2021*

## Document Revision History

Version	Date	Author	Change Sections	Description
1.0	9/13/21	ANG	All	Version 1.0

## Acronyms

Acronym	Definition
<b>ATCS</b>	Air Traffic Control Specialist
<b>ATCT</b>	Airport Traffic Control Tower
<b>AWOS</b>	Automated Weather Observing System
<b>FAA</b>	Federal Aviation Administration
<b>IFR</b>	Instrument Flight Rules
<b>JO</b>	Joint Order
<b>JYO</b>	Leesburg Executive Airport
<b>LOA</b>	Letter of Agreement
<b>LUAW</b>	Line Up and Wait
<b>MATCT</b>	Mobile Airport Traffic Control Tower
<b>NAS</b>	National Airspace System
<b>OTW</b>	Out-the-Window
<b>PIREP</b>	Pilot Report
<b>RCA</b>	Remotely Controlled Airport
<b>RT</b>	Remote Tower
<b>RTC</b>	Remote Tower Center
<b>RTM</b>	Remote Tower Module
<b>RVA</b>	Robinson Aviation, Inc.
<b>SFRA</b>	Special Flight Rules Area
<b>SLG</b>	Signal Light Gun
<b>SSOP</b>	Site-Specific Standard Operating Procedure
<b>SVFR</b>	Special VFR
<b>VFR</b>	Visual Flight Rules

# 1 Introduction

The Federal Aviation Administration (FAA) has conducted extensive operational evaluations of Saab Inc.'s Remote Tower (RT) system capability at Leesburg Executive Airport (JYO) in Leesburg, Virginia since 2016. The RT system utilized at JYO consists of two basic subsystems: the Remotely Controlled Airport (RCA) which is comprised of equipment required to collect video and sensory inputs from the airport; and the Remote Tower Center (RTC) that is comprised of the Remote Tower Module (RTM) equipment required to present the information collected by the RCA to the Air Traffic Control Specialists (ATCSs). During the air traffic operational evaluations, data were collected on the capability of the Air Traffic Control Specialist (ATCS) to use the visual information provided by the RT system to provide Airport Traffic Control Tower (ATCT) services outlined in the FAA Joint Order (JO) 7110.65, *Air Traffic Control*.

## 1.1 Scope

The JYO RT system implementation explored the RT system as an optional replacement for traditional (brick-and-mortar) ATCTs for the provision of Class D ATCT services. The concept described in this document focuses on the implementation of an RT system that replaces the out-the-window (OTW) view from a brick-and-mortar ATCT with a camera view. Therefore, the RT system evaluations supporting this concept are scoped to the visual component of the ATCSs' needs for providing ATCT services (Table 1). As such, the focus of the evaluations was on applicable paragraphs in the FAA JO 7110.65 Chapters 2, 3, and 7.

Table 1: Class D ATCT Services

ID	Class D ATCT Services
<b>S1</b>	<b><i>Air Traffic-Pilot Communication Services</i></b>
S1.1	Manage Radio Communication
S1.2	Manage Clearances, Instructions, or Information
<b>S2</b>	<b><i>Flight Plan Services</i></b>
S2.1	Manage Flight Plan
S2.2	Manage Amended Flight Plan Data
<b>S3</b>	<b><i>Ground Movement Services</i></b>
S3.1	Manage Ground Movement
S3.2	Manage Ground Sequencing and Spacing
S3.3	Manage Runway Separation
S3.4	Manage Takeoff Information and Instructions
S3.5	Manage Takeoff Cancellation and Aborted Takeoff
S3.6	Manage Potential or Actual Ground Conflict
S3.7	Manage Flow Constraint / Traffic Management Initiative
<b>S4</b>	<b><i>Airborne Services</i></b>
S4.1	Manage Overflight
S4.2	Manage Airborne Departure Including Pattern Airborne Departure
S4.3	Manage Arrival Including Pattern Arrival
S4.4	Manage Airborne Sequencing and Spacing
S4.5	Manage Go Around and Missed Approach
S4.6	Manage Potential or Actual Airborne Conflict
S4.7	Manage Potential or Actual Airspace Violation
<b>S5</b>	<b><i>Weather Services</i></b>
S5.1	Manage Weather and Severe Weather Condition Information

ID	Class D ATCT Services
<b>S6</b>	<b><i>Special Operations, Emergency, and Unusual Situation Services</i></b>
S6.1	Manage Unsafe Condition
S6.2	Manage Special Operation
S6.3	Manage Response to Uncontrolled Object / Aircraft
S6.4	Manage Emergency Response
S6.5	Manage Unusual Situation

Beginning in June 2018, the JYO RT operations also included application of the following Site-Specific Standard Operating Procedures (SSOPs):

1. Visual acquisition of VFR aircraft:
  - a. Controllers must instruct all aircraft not on a straight-in approach to proceed to the appropriate downwind for a downwind pattern entry reference known traffic.
  - b. Traffic must be exchanged between all pertinent aircraft utilizing the same downwind.
2. Opposing base/downwind traffic:
  - a. Do not permit an aircraft to turn base leg until the pilot has reported the preceding arriving aircraft in sight.
3. Opposite Direction Operations are not authorized at Leesburg Executive Airport.
4. Overflights and Traffic Advisories:
  - a. Controllers must issue traffic advisories to departing aircraft on all known or observed overflight traffic (as applicable) within 4NM of JYO prior to issuing take-off clearance.
5. Traffic Advisory Phraseology:
  - a. Controllers must use phraseology contained in FAAO JO 7110.65.
6. Short Approach
  - a. Controllers may authorize a short approach when the aircraft requesting the short approach is number one in the landing sequence and there are no other aircraft between it and the runway and sufficient spacing and sequencing is established with succeeding aircraft.
  - b. Controllers must not clear another aircraft for take-off once an aircraft has been instructed to make a short approach.
7. Reporting Point Requests
  - a. Require position reports prior to traffic pattern entry.
8. Tower-applied visual separation is not authorized.

## 1.2 Summary of Findings

The document [Leesburg Executive Airport Remote Tower Project: JO 7110.65 Application Findings Report](#) outlines the evaluation findings in more detail with this document providing a summary of those findings. For more information on the JYO RT system evaluations, please reference the [Leesburg Executive Airport Remote Tower Project: Air Traffic Operational Evaluation Overview](#).

### 1.2.1 Managing Ground Movements

As part of Phase 2 and 3a, the ATCS have observed and managed tens of thousands of ground movement operations. These operations have been managed by ATCSs using the RT system with control positions combined/de-combined to one, two, and three positions. Taxi instructions and observations have been conducted per FAA JO 7110.65 Chapter 3, Section 7 Taxi and Ground Movement Procedures.

### 1.2.2 Runway Status Observations

Throughout all of the testing, ATCSs have utilized the RT system to scan the runway to determine the status of the runway (per FAA JO 7110.65 3-1-12 Visually Scanning Runway). During these runway scans, the ATCSs have utilized the RT system to visually observe and respond to objects impacting the runway per FAA JO 7110.65 3-3-1 Landing Area Condition. These objects have included, but are not limited to, foreign object debris, animals, and pedestrians. Additionally, the ATCSs have utilized the RT system to issue instructions to aircraft for exiting the runway and have monitored the aircraft response per FAA JO 7110.65 3-10-9 Runway Exiting.

### 1.2.3 Runway Separation

In Phase 2, tests were conducted and determined that ATCSs could utilize the RT system to observe aircraft location in relation to the arrival threshold, 3,000' marker, 4,500' marker, runway exit, and departure threshold. (Note: the JYO runway is 5,500'; therefore, there is no 6,000' marker.) Additionally, ATCSs have utilized the RT system in Phases 2 and 3a to ensure and monitor same runway separation per FAA JO 7110.65 3-9-6 and 3-10-3 Same Runway Separation. When the ATCS identified approved same runway separation may not be ensured, the ATCSs responded and issued control instructions to ensure required separation (e.g., issuing go-around instruction due to aircraft delaying runway exit). During Phase 3a, there have been no reported or identified events resulting in loss of runway separation due to the visual information provided by the RT system.

The *Operational Viability Decision for Saab, Inc. Remote Tower* memorandum specifically highlights the following separation services from the FAA JO 7110.65:

- Same runway separation services in accordance with FAA Order JO 7110.65, Air Traffic Control, Paragraphs 3-9-6a1, 2, 3 and 5; Paragraph 3-9-6b; Paragraphs 3-10-3a1; Paragraphs 3-10-3a2(a) and (b); and Paragraph 3-10-3a3.
- Helicopter separation services in accordance with FAA Order JO 7110.65, Paragraphs 3-11-3; and Paragraphs 3-11-4.

Paragraphs 3-9-6a4 and 3-10-3a2(c) were not included in analysis at JYO since both Paragraphs reference the runway 6,000' marker (the JYO runway is 5,500'). Paragraphs 3-9-6c-n and 3-10-3b refer to wake turbulence application. These Paragraphs were not tested at JYO due to airport environment traffic.

Line Up and Wait (LUAW) procedures were not tested at JYO as Robinson Aviation, Inc.(RVA) does not conduct those operations. As such, LUAW as outlined in FAA JO 7110.65 3-9-4 Line Up and Wait is not authorized at JYO.

### 1.2.4 Managing Airborne Operations

Over 5,500 operations in Phase 2 and over 41,000 operations in Phase 3a have been managed by ATCSs using the RT system per FAA JO 7110.65 Chapter 3 Section 9 Departure Procedures and Separation and Chapter 3 Section 10 Arrival Procedures and Separation. These operations have included departure traffic, arrival traffic, overflights, and pattern traffic. In particular, the ATCSs have utilized the RT system to issue clearance and instructions per FAA JO 7110.65 3-9-3 Departure Control Instructions and 3-10-5 Landing Clearance. The ATCSs have utilized the RT visual information in conjunction with other information (e.g., pilot reports) to sequence and space aircraft to achieve proper spacing per FAA JO 7110.65 Chapter 3, Section 8 Spacing and Sequencing, and ensure runway separation per FAA JO 7110.65, Letters of Agreement (LOAs), and SSOPs.

Throughout the National Airspace System (NAS), tower-applied visual separation as described in FAA JO 7110.65 7-2-1 Visual Separation can be applied when authorized by the overlying facility either as outlined in an LOA or when offered by the ATCT. This is a method for providing separation services, as appropriate and applicable. For a variety of reasons, not all Class D ATCTs are authorized to provide tower-applied visual separation. JYO ATCT (both from the RTM and Mobile ATCT [MATCT]) is among those ATCTs in



the NAS where the overlying facility does not authorize ATCSs to provide tower-applied visual separation services. The result is the JYO ATCT (both the RTM and MATCT) is among those ATCTs in the NAS where ATCSs are not authorized to provide tower-applied visual separation services per Air Traffic Services (AJT) Headquarters decision. Additionally, due to JYO's airspace relationship to the Special Flight Rules Area (SFRA), Special Visual Flight Rules (VFR) operations (described in FAA JO 7110.65 Chapter 7, Section 5 Special VFR) are not authorized at JYO by the JYO Airport Manager per the Potomac TRACON LOA.

### **1.2.5 Traffic Information and Safety Alerting**

As part of Phase 2 and 3a operations, the ATCSs utilized the visual information obtained from the RT system in conjunction with other external information (e.g., radio communications) to issue safety alerts, traffic advisories, and traffic information. Specifically, the RT system at JYO has been utilized to provide the traffic information services described in FAA JO 7110.65 2-1-6 Safety Alert, 2-1-21 Traffic Advisories, and 3-1-6 Traffic Information.

### **1.2.6 General Weather Observations**

At JYO, ATCSs gather weather information from the Automated Weather Observing System (AWOS), pilot reports (PIREPs), visual information from the RT system, and other sources. In Phase 2, general weather observations were collected using the RT system per FAA JO 7110.65 2-6-3 Reporting Weather Conditions and 2-6-5 Disseminating Official Weather Information. In Phase 3a, ATCSs continued making general weather observations using the RT system and disseminating the information.

ATCSs also monitored the tower prevailing visibility using the RT system during Phase 2 and Phase 3a. When the tower prevailing visibility was less than 4 miles, ATCSs took prevailing visibility observations per FAA JO 7110.65 2-6-3 Reporting Weather Conditions.

Those weather observations that are required to be made by certified weather observers as described in JO 7900.5, *Surface Weather Observing*, were not evaluated. At this time, ATCSs using the RT system are not approved to become official weather observers.

### **1.2.7 Managing Emergencies and Unusual Situations**

During Phases 1 and 2, emergency and unusual situations were simulated with hired aircraft and managed by ATCSs using the RT system. In Phase 3a, a variety of emergency and unusual situations as a result of ATCT operations were managed by ATCSs using the RT system. While a variety of emergencies and unusual situations have been managed by ATCSs using the RT system, specific focus was on two operations – signal light gun (SLG) situations and gear checks. Specifically, evaluations in Phases 2 and 3a and normal operations in Phase 3a have included the use of the RT system's SLG and the observation of the aircraft's response using the RT system visual information. The ATCSs have demonstrated the ability to use the RT system to send visual signals and observe responses per FAA JO 7110.65 Chapter 3, Section 2 Visual Signals. As part of Phase 2, gear checks were conducted on over 1,400 arrival operations. The ATCSs have demonstrated the ability to use the RT system to perform gear checks per FAA JO 7110.65 3-1-10 Observed Abnormalities.



**FAA**

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

# **Leesburg Executive Airport Remote Tower Project**

## ***Air Traffic Operational Evaluations Overview***

*Version No. 1.0*

*Document Date: September 13, 2021*

## Document Revision History

Version	Date	Author	Change Sections	Description
1.0	9/13/21	ANG	All	Draft Outline

## Acronyms

Acronym	Definition
<b>3b-M</b>	3b – Maintenance
<b>3b-O</b>	3b – Operations
<b>AT</b>	Air Traffic
<b>ATC</b>	Air Traffic Control
<b>ATCS</b>	Air Traffic Control Specialist
<b>ATCT</b>	Airport Traffic Control Tower
<b>FAA</b>	Federal Aviation Administration
<b>FAAOO</b>	FAA Official Observer
<b>IOC</b>	Initial Operating Capability
<b>JO</b>	Joint Order
<b>JYO</b>	Leesburg Executive Airport
<b>LOA</b>	Letter of Agreement
<b>MATCT</b>	Mobile Airport Traffic Control Tower

Acronym	Definition
<b>MOR</b>	Mandatory Occurrence Report
<b>OTW</b>	Out-the-Window
<b>RCA</b>	Remotely Controlled Airport
<b>RT</b>	Remote Tower
<b>RTC</b>	Remote Tower Center
<b>RTM</b>	Remote Tower Module
<b>SRM</b>	Safety Risk Management
<b>SSOP</b>	Site-Specific Standard Operating Procedure
<b>ToO</b>	Targets of Opportunity
<b>V&amp;V</b>	Validation & Verification

# 1 Introduction

The Federal Aviation Administration (FAA) has conducted extensive operational evaluations of Saab Inc.'s Remote Tower (RT) system capability at Leesburg Executive Airport (JYO) in Leesburg, Virginia since 2016. The RT system utilized at JYO consists of two basic subsystems: the Remotely Controlled Airport (RCA) which is comprised of equipment required to collect video and sensory inputs from the airport; and the Remote Tower Center (RTC) that is comprised of the Remote Tower Module (RTM) equipment required to present the information collected by the RCA to the Air Traffic Control Specialists (ATCSs). The RTC was initially located on airport property and was relocated to the permanent location off of airport property. During the transition period of October 2019 to April 2021, ATCT services were provided from the Mobile ATCT (MATCT), and the RTM resumed providing ATCT services in April 2021 from the permanent location.

## 1.1 Scope

The RT concept utilizes a series of camera sensors located at the airport and display screens located in the RTM without additional surveillance information (e.g., radar). This concept is often called "RT Visual Only." ATCSs utilize the information displayed on the screens to replace the visual information obtained from the out-the-window (OTW) view used in a traditional Airport Traffic Control Tower (ATCT) facility. ATCT services (listed in Table 1) are provided using the information presented by the RT system in conjunction with existing ATCT minimum equipment mandated by the FAA. ATCSs using the RT system to provide ATCT services must adhere to the same Air Traffic Control (ATC) procedures in use at a traditional ATCT as per FAA Joint Orders (JO), in particular JO 7110.65, JO 7210.3, and Letters of Agreement (LOAs).

The FAA developed and implemented a formal strategy for evaluating the air traffic viability of the RT system installed for the JYO environment. The FAA implementation approach is to integrate RT technology as a viable option for service provision once the FAA has operationally and technically evaluated this technology. The FAA operational evaluations explore the RT system as an optional replacement for traditional (brick-and-mortar) ATCTs for the provision of Class D ATCT services. Therefore, the RT system evaluations supporting this concept are scoped to the visual component of the ATCSs' needs.

Table 1: Class D ATCT Services

ID	Class D ATCT Services
<b>S1</b>	<b><i>Air Traffic-Pilot Communication Services</i></b>
S1.1	Manage Radio Communication
S1.2	Manage Clearances, Instructions, or Information
<b>S2</b>	<b><i>Flight Plan Services</i></b>
S2.1	Manage Flight Plan
S2.2	Manage Amended Flight Plan Data
<b>S3</b>	<b><i>Ground Movement Services</i></b>
S3.1	Manage Ground Movement
S3.2	Manage Ground Sequencing and Spacing
S3.3	Manage Runway Separation
S3.4	Manage Takeoff Information and Instructions
S3.5	Manage Takeoff Cancellation and Aborted Takeoff
S3.6	Manage Potential or Actual Ground Conflict
S3.7	Manage Flow Constraint / Traffic Management Initiative
<b>S4</b>	<b><i>Airborne Services</i></b>
S4.1	Manage Overflight
S4.2	Manage Airborne Departure Including Pattern Airborne Departure

ID	Class D ATCT Services
S4.3	Manage Arrival Including Pattern Arrival
S4.4	Manage Airborne Sequencing and Spacing
S4.5	Manage Go Around and Missed Approach
S4.6	Manage Potential or Actual Airborne Conflict
S4.7	Manage Potential or Actual Airspace Violation
<b>S5</b>	<b>Weather Services</b>
S5.1	Manage Weather and Severe Weather Condition Information
<b>S6</b>	<b>Special Operations, Emergency, and Unusual Situation Services</b>
S6.1	Manage Unsafe Condition
S6.2	Manage Special Operation
S6.3	Manage Response to Uncontrolled Object / Aircraft
S6.4	Manage Emergency Response
S6.5	Manage Unusual Situation

## 1.2 Air Traffic Operational Evaluation Overview

The JYO RT system evaluations are a phased approach of data collection focused on visual acuity and depth perception as well as general system usability for the provision of Class D ATCT services. Additionally, the RT system capability has been examined in various Safety Risk Management (SRM) assessments throughout the evaluation phases. Figure 1 shows the overview of the JYO RT operational evaluations with Figure 2 showing a more detailed view. Table 2 lists the supporting documents for each evaluation phase.

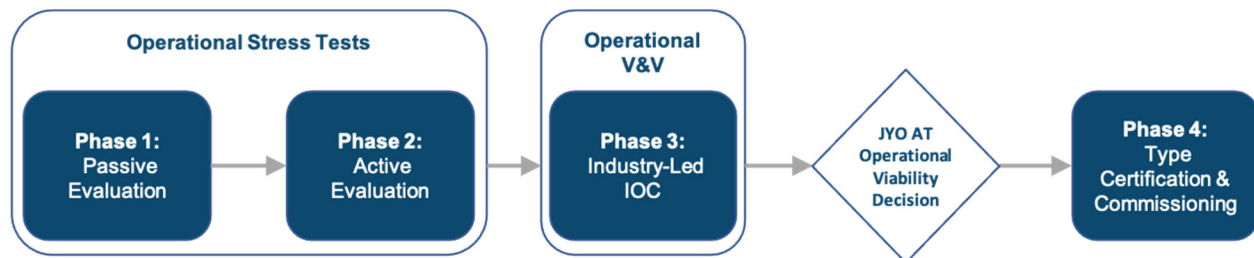


Figure 1: JYO RT Operational Evaluation Overview

The JYO RT Operational Evaluations are divided into two categories – stress tests and operational Validation and Verification (V&V). Those two categories are subdivided into the following sections:

- Operational Stress Tests
  - **Phase 1 Passive Evaluation** was conducted in Fall 2016. MATCT served as the active facility with RTM in passive mode. Scripted scenarios and operational traffic were utilized.
  - **Phase 2 Active Evaluation** was conducted in Summer 2017. Primarily, the RTM served as the active facility with the MATCT as the staffed backup facility. Scripted scenarios and ToO traffic were utilized. Tests with up to six aircraft simultaneously in the area of responsibility were conducted. Some additional passive evaluations were conducted at the beginning of Phase 2 with the MATCT serving as the active facility; however, the overwhelming proportion of Phase 2 was with the RTM serving as the active facility.
- Operational V&V
  - **Phase 3a Industry-led Initial Operating Capability (IOC)** was conducted starting in June 2018. Primarily, the RTM served as the active facility with the MATCT not staffed. ToO

traffic was utilized. JYO RTM provided Class D ATCT services to JYO traffic, and Site-Specific Standard Operating Procedures (SSOPs) for spacing and sequencing airborne aircraft were in place.

- Additional activities included the observation of the clearance delivery function, the increase in the curvature of RT visual presentation, and the transition to the new RTM location. Visual observations for MATCT and RTM comparisons were conducted.
- Phase 3b included two tests – **3b-Operations (3b-O)** was conducted in Spring 2019 and evaluated the consolidation of control positions in the RTM. **3b-Maintenance (3b-M)** was conducted in June 2019 and evaluated the RTM critical and non-critical failure modes. Operational V&V activities were subsequently continued to include the V&V of all Phase 3b test findings and resulting SRM panel determinations.

During the Operational Stress Tests, over 6,000 aircraft and vehicle movements were actively controlled by ATCSs in the RTM with over 175 hours of testing. During the V&V evaluations, industry-led IOC operations were conducted from June 2018 to September 2019 and resumed in April 2021. The RTM was being relocated to the permanent off-site location from October 2019 to April 2021, and during this time, ATCT services were provided from the MATCT. Based on the implementation of SRM outcomes, SSOPs were developed and implemented. As of May 31, 2021, over 3,000 hours of ATCT services were provided by ATCSs in the RTM for over 47,000 traffic operations. All 24 ATCT services have been provided during V&V operations by ATCSs in the RTM. Over 1,000 hours of FAA Official Observer (FAAO) evaluations were conducted. Over 290 Mandatory Occurrence Reports (MORs) were filed by ATCSs and reviewed by FAAOs. One minor severity situation occurring on April 10, 2019, was investigated in depth by the FAA Core Team and Management, but the event was determined to not have crossed the safety performance target threshold. As of the publication of this document, all safety performance targets have been met.

Table 2: JYO Operational Evaluation Phase Overview Documents

Evaluation Phase	File Name	Document Title
Phase 1	JYO Phase 1 Evaluation Overview_2020-06-22	<a href="#">Leesburg Executive Airport Remote Tower Project: Phase 1 Overview</a>
Phase 2	JYO Phase 2 Evaluation Overview_2020-06-22	<a href="#">Leesburg Executive Airport Remote Tower Project: Phase 2 Overview</a>
Phase 3	JYO Phase 3 Evaluation Overview_2020-06-22	<a href="#">Leesburg Executive Airport Remote Tower Project: Phase 3 Overview</a>

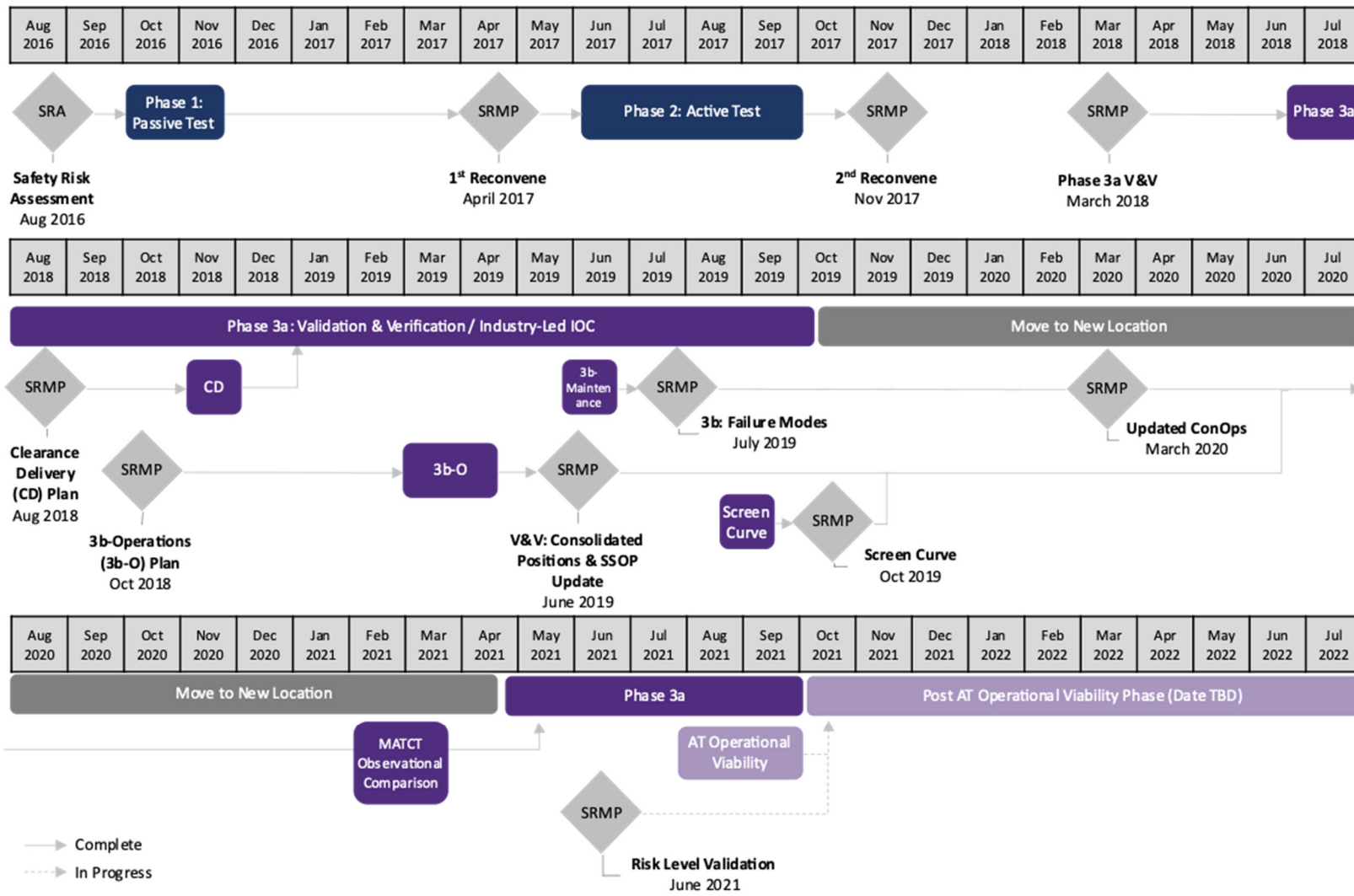


Figure 2: JYO RT Operational Evaluation Timeline



**FAA**

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

# **Leesburg Executive Airport Remote Tower Project**

## ***Safety Risk Management Overview***

*Version No. 1.0*

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## Document Revision History

Version	Date	Author	Change Sections	Description
1.0	9/13/21	ANG	All	Version 1.0

## Acronyms

Acronym	Definition
<b>AT</b>	Air Traffic
<b>ATCS</b>	Air Traffic Control Specialist
<b>ATO</b>	Air Traffic Organization
<b>ConOps</b>	Concept of Operations
<b>FAA</b>	Federal Aviation Administration
<b>JYO</b>	Leesburg Executive Airport
<b>NMAC</b>	Near Mid-Air Collision
<b>RCA</b>	Remotely Controlled Airport
<b>RI</b>	Runway Incursion
<b>RT</b>	Remote Tower
<b>RTC</b>	Remote Tower Center
<b>RTM</b>	Remote Tower Module
<b>SMS</b>	Safety Management System
<b>SRM</b>	Safety Risk Management
<b>SRMD</b>	Safety Risk Management Document
<b>V&amp;V</b>	Validation & Verification

# 1 Introduction

The Federal Aviation Administration (FAA) has conducted extensive operational evaluations of Saab Inc.'s Remote Tower (RT) system capability at Leesburg Executive Airport (JYO) in Leesburg, Virginia since 2016. The RT system utilized at JYO consists of two basic subsystems: the Remotely Controlled Airport (RCA) which is comprised of equipment required to collect video and sensory inputs from the airport; and the Remote Tower Center (RTC) that is comprised of the Remote Tower Module (RTM) equipment required to present the information collected by the RCA to the Air Traffic Control Specialists (ATCSs). During the air traffic operational evaluations, Safety Risk Management (SRM) assessments were conducted in accordance with the Air Traffic Organization (ATO) Safety Management System (SMS) Manual for three different series of assessments for the JYO RT project:

- Concept of Operations (ConOps) Series: Assessed the end-state RT operations at JYO
- Testing Series: Assessed the execution of test activities described in evaluation plans at JYO
- Validation & Verification (V&V) Series: Assessed the execution of V&V operations at JYO

Figure 1 depicts the timeline of the various SRM activities. All documents listed in Tables 1, 3, 4, and 5 (which summarize all of the SRM documents with hyperlinks) can be found in the accompanying SRM appendix documents.

## 1.1 ConOps Series

The JYO ConOps series SRM assessments and resulting SRMDs are listed in Table 1.

Table 1: JYO ConOps SRM Activities

ID	ConOps SRM Subject	File Name	Panel Date
<b>ConOps 01</b>	JYO Preliminary Safety Assessment	<a href="#">ConOps 01-RTS at JYO Preliminary Safety Assessment 2020-06-10</a>	Aug 2016
<b>ConOps 02</b>	Initial ConOps Assessment	<a href="#">ConOps 02-RTS at JYO Intl ConOps SRM Document 2020-06-02</a>	Nov 2017
<b>ConOps 03</b>	Phase 3b Failure Modes	<a href="#">ConOps 03-RTS at JYO Phase 3b-M 2020-05-28</a>	Jul 2019
<b>ConOps 04</b>	Visual Presentation Curvature	<a href="#">ConOps 04-RT System Visual Pres Curvature 2020-05-21</a>	Oct 2019
<b>ConOps 05</b>	Updated ConOps Assessment	<a href="#">ConOps 05-Updated ConOps Assessment 2020-07-07</a>	Mar 2020
<b>ConOps 06</b>	Updated ConOps Assessment with Risk Level Validation	<a href="#">ConOps 06- RTS at JYO Updated ConOps Assessment 2021 Updates With Addendum 2021-08-31</a>	Jun 2021

The ConOps 01 assessment initially identified the following two hazards:

- ConOps Hazard 1: The visual information presented by the RT system impacts controller detection and identification of objects, affecting the provision of ATCT services
- ConOps Hazard 2: The visual information presented by the RT system impacts controller perception of spatial relationships, affecting the provision of ATCT services

These hazards were found to have ten sub-hazards, each describing which aspect of ATCT operations could be impacted by the RT system. The ConOps 02 assessment assessed the hazards to determine the initial risk level. The hazards and sub-hazards were updated/reassessed as the system state changed (e.g., new location transition), as new aspects were added to the JYO RT operations (e.g., the addition of Site-Specific Standard Operating Procedures), and as additional tests were conducted (ConOps 03 and 04). During the ConOps 05 assessment, the SRM panel found that the following sub-hazards were determined to not be introduced or impacted by the RT system itself:

- Hazard 1a: Detection/identification of non-cooperating traffic, wildlife, vehicles, or pedestrians
- Hazard 1b: Detection/identification of Foreign Object Debris
- Hazard 1c: Detection/identification of abnormal conditions

- Hazard 1d: Detection/identification of weather or airport/runway conditions
- Hazard 2e: Spatial relationships when there is a potential adjacent airspace violation

The ConOps 05 and 06 assessments updated and validated the assessment of the hazards in Table 2, which also details the ongoing safety performance targets for those hazards.

Table 2: JYO ConOps Hazards

ID	Hazard	Effect	Initial & Predicted Residual Risk	Safety Performance Targets
ConOps 1e	Detection and identification of the need to manage airport lighting	Effect 1: Cat D RI	Low (5C)	Zero Cat C RIs caused by the mismanagement of airport lighting due to overlay on the RT visual presentation
		Effect 2: Unplanned go-around	Low (5C)	
ConOps 2 a/b/c	Spatial relationships between aircraft or aircraft and vehicles/pedestrians on the movement area	Effect 1: Cat D RI	Low (5C)	Zero CAT C RIs caused by the visual presentation's impact on controller's visual perception of spatial relationships
		Effect 2: Minor Pilot Deviation	Medium (4C)	
ConOps 2d	Spatial relationships between arriving and departing traffic	Cat C NMAC (pertains to arrival/arrival operations only)	Medium (4B)	Zero Cat A or B NMACs caused by the visual presentation's impact on controller's visual perception of spatial relationship

## 1.2 Testing Series

The JYO testing series SRM assessments apply to the execution of testing activities that impact operations. Table 3 outlines those activities.

Table 3: JYO Testing SRM Activities

ID	Testing SRM Subject	File Name	Panel Date
<b>Test 01</b>	Phase 1 Evaluation Plan Execution	<a href="#">Test 01-Phase 1 Execution 2016-09-27</a>	Aug 2016
<b>Test 02</b>	Phase 2 Evaluation Plan Execution	<a href="#">Test 02-Phase 2 Testing SRMD 2020-10-08</a>	Apr 2017
<b>Test 03</b>	Phase 3b-Operations Execution	<a href="#">Test 03-Phase 3b-Ops SRMD 2020-06-17</a>	Oct 2018

The hazards identified and assessed by this series applied only during the periods of the Phase 1 testing (October – November 2016), Phase 2 testing (July – September 2017), and Phase 3b-O testing (March – April 2019).

### 1.3 V&V Series

The JYO V&V series SRM assessments apply to the execution of the V&V activities that began in June 2018. Table 4 outlines those activities.

Table 4: JYO V&V SRM Activities

ID	V&V SRM Subject	File Name	Panel Date
<b>V&amp;V 01</b>	Phase 3a V&V	<a href="#">V&amp;V 01 Phase 3a of RTS at JYO SRM Addendum_2020-06-09</a>	Mar 2018
<b>V&amp;V 02</b>	V&V with Consolidated Controller Positions	<a href="#">V&amp;V 02 Extended V-V w consolidated positions_2020-07-12</a>	Jun 2019

The hazards identified and assessed by this series applied only during the periods of the V&V activities (June 2018 – Sept 2019 and April 2021 – September 2021).

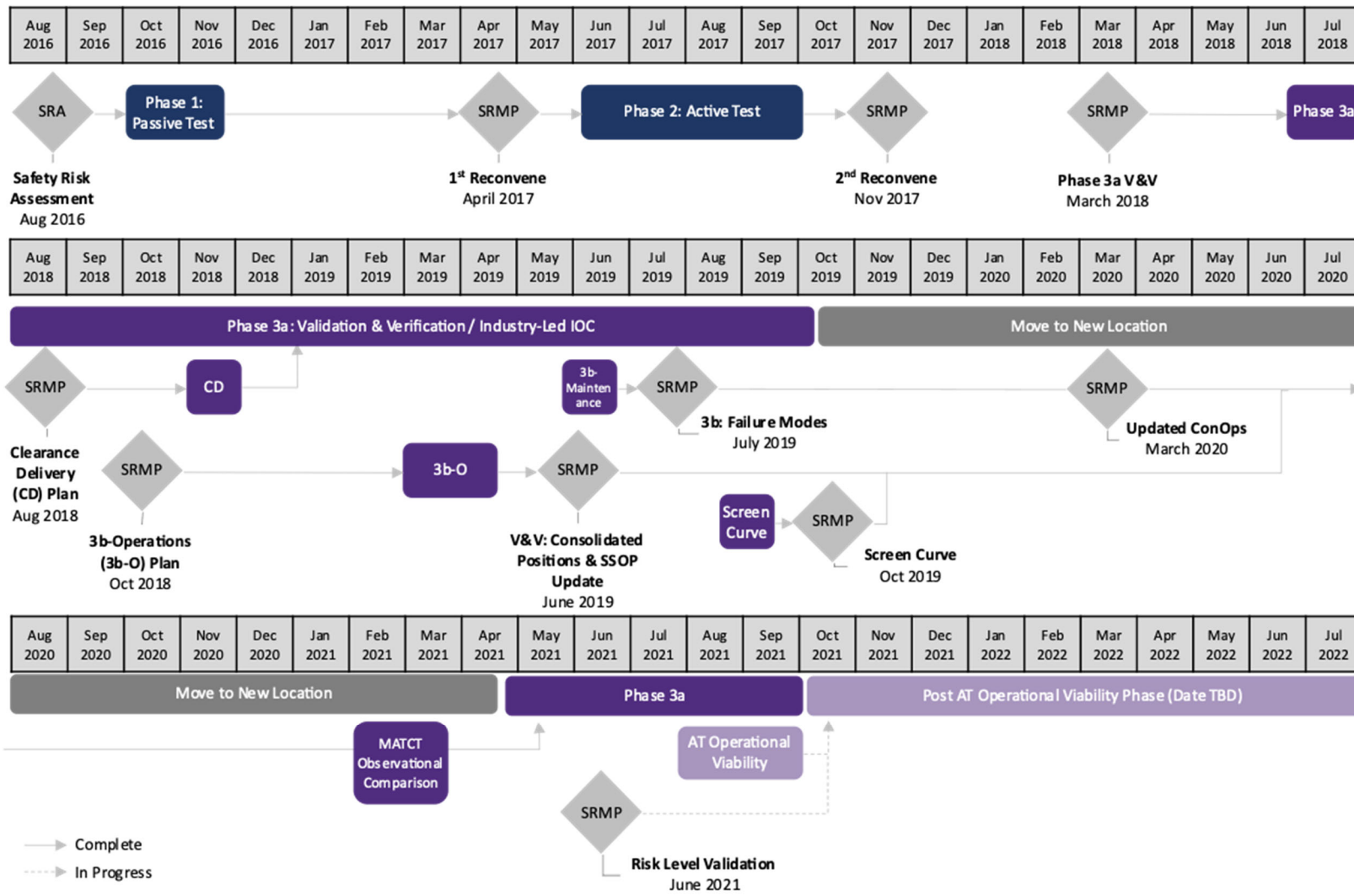


Figure 1: JYO RT Operational Evaluation Timeline

Table 5: JYO SRM Documents

ID	SRMD Subject	File Name	Document Title	Panel Date
<b>ConOps 01</b>	JYO Preliminary Safety Assessment	ConOps 01-RTS at JYO Preliminary Safety Assessment_2020-06-10	<a href="#">Remote Tower Services at Leesburg Executive Airport Concept of Operations Series: Preliminary Safety Assessment</a>	Aug 2016
<b>ConOps 02</b>	Initial ConOps Assessment	ConOps 02-RTS at JYO Intl ConOps SRM Document_2020-06-02	<a href="#">Remote Tower Services at Leesburg Executive Airport Concept of Operations Series: Initial Concept of Operations Assessment</a>	Nov 2017
<b>ConOps 03</b>	Phase 3b Failure Modes	ConOps 03-RTS at JYO Phase 3b-M_2020-05-28	<a href="#">Remote Tower Services at Leesburg Executive Airport Concept of Operation Series: Phase 3b – Maintenance</a>	Jul 2019
<b>ConOps 04</b>	Visual Presentation Curvature	ConOps 04-RT System Visual Pres Curvature_2020-05-21	<a href="#">Remote Tower Services at Leesburg Executive Airport Concept of Operations Series: Remote Tower System Visual Presentation Curvature</a>	Oct 2019
<b>ConOps 05</b>	Updated ConOps Assessment	ConOps 05-Updated ConOps Assessment_2002-07-07	<a href="#">Remote Tower Services at Leesburg Executive Airport Concept of Operations Series: Updated Concept of Operations Assessment</a>	Mar 2020
<b>ConOps 06</b>	Updated ConOps Assessment with Risk Level Validation	ConOps 06- RTS at JYO Updated ConOps Assessment_2021 Updates With Addendum_2021-08-31	<a href="#">Remote Tower Services at Leesburg Executive Airport Concept of Operations Series: Updated Concept of Operations Assessment with Addendum</a>	Jun 2021
<b>Test 01</b>	Phase 1 Evaluation Plan Execution	Test 01-Phase 1 Execution_2016-09-27	<a href="#">Hazards and Effects of Running the Scripted Scenarios During Phase 1B Testing at Leesburg Executive Airport as Described in the Saab Sensis Remote Tower Evaluation Plan Remote Tower Services at Leesburg Executive Airport, Version: 1, 15 July 2016</a>	Aug 2016
<b>Test 02</b>	Phase 2 Evaluation Plan Execution	Test 02-Phase 2 Testing SRMD_2020-10-08	<a href="#">Remote Tower Services at Leesburg Executive Airport Testing Series: Phase 2 Testing</a>	Apr 2017
<b>Test 03</b>	Phase 3b-Operations Execution	Test 03-Phase 3b-Ops SRMD_2020-06-17	<a href="#">Remote Tower Services at Leesburg Executive Airport Testing Series: Phase 3b – Operations</a>	Oct 2018
<b>V&amp;V 01</b>	Phase 3a V&V	V&V 01_Phase 3a of RTS at JYO SRM Addendum_2020-06-09	<a href="#">Remote Tower Services at Leesburg Executive Airport Verification and Validation Series: Phase 3a Verification and Validation</a>	Mar 2018
<b>V&amp;V 02</b>	V&V with Consolidated Controller Positions	V&V 02_Extended V-V w consolidated positions_2020-07-12	<a href="#">Remote Tower Services at Leesburg Executive Airport Verification and Validation Series: Extended Verification and Validation with Consolidated Controller Positions</a>	Jun 2019