REMOTE TOWERS: PRESENT & FUTURE

COLORADO SPRINGS, COLORADO
September 12-15

HONOR THE PAST ★ EMBRACE THE FUTURE

COLORADO DIVISION OF AERONAUTICS

SEARIDGE TECHNOLOGIES

SAAB

NORTHERN COLORADO REGIONAL AIRPORT

FEDERAL Aviation ADMINISTRATION

NextGEN

Town of Leesburg, Virginia

LEESBURG EXECUTIVE AIRPORT
In the future buzzing the Tower just won’t be the same...
Air Traffic Control Remote Tower Alternative

14 September 2021

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U.S. Certification Project… Leesburg, VA

- Leesburg Executive Airport (JYO) Goals
  - Reduce delays for IFR traffic
  - Provide greater safety margins for VFR traffic
  - Aid Special Flight Rules Area (SFRA) operations

- FAA NextGen Pilot Site #1 Goals
  - Determine if system is operationally acceptable for VFR tower
  - Define non-federal RT standards and associated approval process

- Saab Goals
  - Establish rTWR demonstration system
  - Obtain FAA approval and certification for VFR tower services
  - Demonstrate potential benefits to NAS

- Public-private partnership established 2014
  - Virginia SATSLab, Inc. (VSATS)
  - Leesburg Executive Airport
  - Saab Sensis
  - Advisory partners… FAA, DOAV and NATCA
Leesburg Executive Airport (JYO)

- JYO
  - Non-towered operations in Class E/G airspace
  - 2\textsuperscript{nd} busiest GA airport in VA
  - Designated GA reliever for Washington-Dulles International Airport (IAD), ~ 9 miles southeast

- Operational Profile
  - ~ 115,000 operations/year
  - 250 based aircraft
  - Over 40% of aircraft commercially-operated (e.g., rentals, business owners, flight schools)
Remote Tower “Crows Nest”

- 14 high-definition (HD) cameras
- Two pan/tilt/zoom (PT) electro-optical cameras with 30x zoom and integrated infrared (IR) camera
- Signal light gun (SLG)
- Microphones
- Pressurized camera house with “AirBlade” mitigates:
  - Rain, snow, hail, moisture and dust
  - Temperature extremes
  - Sunlight
  - Insects and birds
- Size: ~ 5’ diameter x 8’ height
Permanent rTWR Installation at JYO

- Centralized camera mast
  - Midfield on terminal building rooftop ~ 50’ AGL
- New 1600 sf Remote Tower Center
  - Off-airport ~ ¼ mile north
  - Meets FAA Contract Tower (FCT) program requirements
- Includes tower minimum equipment list (MEL) items and FAA equipment
  - Landlines
  - Radios and voice switches
  - STARS tower display
  - Flight data entry device (FDIO)
  - Backup weather sensor
Leesburg Certification Project Status

• Jun ’18 – Sep ‘19: Saab-led rTWR Initial Operating Capability (IOC) Phase 3b
  • FAA Validation / Verification (V&V): Hazard Monitoring and Control Tower Service
  • Air Traffic requirements for non-radar configuration

• April - present: IOC Phase 3c
  • From new RTC facility
  • Awaiting FAA Air Traffic approval and STARS radar display

• In-process: Phase 4
  • FAA Advisory Circular
  • Type certification
  • Site commissioning
FAA rTWR Validations at JYO

- Operational Stress Tests
  - Focus on hazards tied to visual acuity and depth perception
  - Scripted scenarios with hired aircraft to increase complexity
  - Over 6,000 aircraft and vehicle movements controlled by RVA

- Validation and Verification (V&V)
  - Long-term operations during IOC with monitoring of ATCT services and safety performance targets
  - Over 2,500 hours of operations
  - Over 33,000 operations performed by RVA controllers
  - Over 950 hours of FAA observer evaluations
  - 265 Mandatory Occurrence Reports (MORs) reviewed by FAA

Data provided by FAA NextGen Program Office

Anticipate FAA Air Traffic “Operational Viability” Decision Memo by End-September '21

Now at 60,000+ operations
### Tower Comparison

<table>
<thead>
<tr>
<th>Traditional Tower</th>
<th>Remote Tower</th>
</tr>
</thead>
<tbody>
<tr>
<td>A unique facility designed to provide air traffic controllers with an unobstructed view of the airport movement area and local airspace.</td>
<td>A typical commercial building providing air traffic controllers a comprehensive view of the airport surface and local airspace by employing variety of sensors and displays.</td>
</tr>
</tbody>
</table>

#### Advantages
- Widely used standard for 90 years
- Certified to provide airport traffic control
- Straightforward development siting, design and construction

#### Disadvantages
- Requires 3-5 years to site, design and construct
- Fixed structure not readily adaptable to accommodate airport growth
- Not easily repurposed at the end of useful life
- High capital and O&M cost
- Visibility limited by weather conditions & lighting conditions

#### Advantages
- System is scalable and expandable for airport growth
- Enhanced situational awareness and visibility through visual target designation, tagging and tracking based on sensor inputs (radar, ADS-B, visual, IR, etc.)
- Digital video technologies, such as stitching and digital zooming, coupled with tracking pan-tilt-zoom cameras
- Potential lower capital costs

#### Disadvantages
- Video display cannot exactly reproduce the out-of-the-window view from a traditional tower
- Currently there is no certified remote tower system
- Tower “buzzing” will not have the same impact
Path to Remote Tower Certification

Operational Certification

Phase 1

- Mobile ATCT – Active ATC Services
- Remote Tower- Shadow Mode

Phase 2

- Remote Tower – Active ATC Services
- Mobile ATCT – Passive

Phase 3

Certified – Class D AT Services

Phase 4

Industry lead IOC

Equipment Type Certification

Equipment:
- a. COTS – Cameras, Video Display, etc
- b. Video Processing – Software, Server, etc.
- c. MEL – Dasi, ATIS, AWOS, Radios, etc.

Facility Certification

Facility:
- a. Facility Meets FCT MEL requirement
- b. Security
- c. Infrastructure.
Northern Colorado Regional Airport (FNL) Distributed Camera Information

360° Camera Array
14 Panoramic Cameras
2 PTZ Cameras
PTZ Signal Light Gun

220° Camera Array
7 Panoramic Cameras
2 Fixed Zoom Cameras

220° Camera Array
7 Panoramic Cameras
2 Fixed Zoom Cameras

Airport Data:
• General & Commercial Aviation
  • Scheduled Service – October 2021
• Two Runways
  • Runway 15-33 - 8,500’
  • Runway 6-24 – 2,273’
• Annual Operations - 94,900+

FNL Remote Tower System Configuration:
• Distributed Camera Arrays
• Stitched video display
• Track-based (radar) display
  • Integrated radar - targets and tags on video displays
  • Standalone STARS Radar display
• Video tracking
• Video Wall - Compressed 360° view
• Three individual controller working positions with HMI, panning video and radar displays
Control Room Video Wall and Controller Working Positions
FNL Airfield System Component Locations

- Center Camera Mast
- Runway End Masts
- Control Facility
<table>
<thead>
<tr>
<th>Cost Element</th>
<th>Legacy ATCT</th>
<th>Remote Tower</th>
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<tbody>
<tr>
<td>Captial Costs - Estimated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Remote Tower facility (2,000+ SqFt)</td>
<td></td>
<td>$850,000</td>
</tr>
<tr>
<td>ATCT and base building - 65' (cab eye height)</td>
<td>$4,525,000</td>
<td></td>
</tr>
<tr>
<td>Special Equipment (FAA-FDIO, Shoutline, etc.)</td>
<td>$85,000</td>
<td>$85,000</td>
</tr>
<tr>
<td>FCT ATCT Minimum Equipment List (MEL)</td>
<td>$425,000</td>
<td>$425,000</td>
</tr>
<tr>
<td>Remote Tower Video Surveillance System/Equipment</td>
<td></td>
<td>$3,225,000</td>
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<tr>
<td>Remote Tower Spares (cameras and displays)</td>
<td></td>
<td>$45,000</td>
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<tr>
<td>STARS Remote Tower Display</td>
<td>$850,000</td>
<td>$850,000</td>
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<tr>
<td>Remote Tower Airfield Infrastructure (Mast, Power &amp; Comm)</td>
<td>$550,000</td>
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<tr>
<td>Site Work/Airfield Infrastructure</td>
<td>$675,000</td>
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<tr>
<td>Sub-Total</td>
<td>$6,560,000</td>
<td>$6,030,000</td>
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<tr>
<td>Contingency (15%)</td>
<td>$984,000</td>
<td>$904,500</td>
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<tr>
<td>Total</td>
<td>$7,544,000</td>
<td>$6,934,500</td>
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Note:

Cost for both legacy ATCT and Remote Tower will vary based on airport configuration and existing infrastructure.

Remote tower system/equipment cost reflect unknows due certification.
Remote Towers
Today, Tomorrow and Future

**Today**

Out-of-the-Window View of airport surface and local airspace provided to the controllers:
- Via Electro-Optical sensors (visual and IR Cameras)
- Airspace Situational Awareness
- Track-Based (radar)

**Tomorrow**

Synthetic Out-of-the-Window View of airport surface and local airspace:
- Modeled from geo-special mapping
- Aircraft and ground vehicles displayed as simulations with data tags

Airspace and Surface Situational Awareness
- Track-Based (radar)

**Future**

Fully Automated Airport Traffic Control:
- Aircraft sequence and self separate using aircraft automation
- Conflict and MSAW alerts from on-board and ground-based automation.

Aircraft and ground vehicle position derived from ground and space-based surveillance sources.