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ADVANCING REMOTE TOWER DEPLOYMENT IN THE UNITED STATES

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PART 1

INTRODUCTION

Remote air traffic control towers, sometimes referred to as virtual towers or digital towers, are being deployed in increasing numbers around the world. Rather than building a tall concrete structure with a control cab on top to house the controllers for visual views of aircraft movements, a steel tower (or several towers) is mounted with an array of video cameras and communications equipment.[1] Those cameras and sensors feed information securely to controllers in a ground-level building housing the control room, often in a location remote from the airfield. Instead of the traditional out-the-window view, controllers have panoramic video displays of the airfield and its environs, including identifying individual aircraft with tags displayed on-screen. This allows them to continuously monitor traffic without turning their head or standing, which is critical for safe and efficient air traffic management.

Remote towers provide the ability to serve low-activity airports from locations where controllers live or desire to live, rather than requiring staff relocations. Management of multiple remote towers can be conducted from a single facility known as a remote tower center. Regardless of how these technologies are deployed, traffic procedures are unchanged from those used in traditional tower operations. While controllers working in a remote tower center can be certified to handle traffic at multiple airports, they only control traffic at one airport at a time. This allows for control of a particular airport to be easily

1 Stephen D. Van Beek, “Remote Towers: A Better Future for America’s Small Airports,” Policy Brief No. 143, Reason Foundation, July 2017. https://reason.org/wp-content/uploads/2017/07/air_traffic_control_remote_towers-1.pdf (15 Apr. 2025).

transferred to a second controller as the need arises. As a result, remote tower technology has the potential to maximize utilization of the limited national pool of certified controllers.

> *… remote tower technology has the potential to maximize utilization of the limited national pool of certified controllers.*

The United States is not alone in facing difficulties in attracting and retaining staff to operate control towers, especially those located far from population centers. But many air navigation service providers have begun adopting remote towers, and they have found that the digital working environments supporting multiple airports are attractive to younger prospective recruits.[2] And by increasing controller situational awareness, this technology also reduces workload and stress, helping to retain these highly trained and specialized employees.

Significant cost savings can also be realized. Construction costs for remote towers are a fraction of those for conventional brick-and-mortar towers. When several low-activity airports are controlled from a single remote tower center, air navigation service providers can realize significant staff and operating cost savings. Importantly, this does not reduce the demand for controllers nationwide, but it does mean that existing and new controllers can be employed more productively.

New airspace entrants, such as electric vertical takeoff-and-landing (eVTOL) aircraft operating advanced air mobility (AAM) services, already plan to make use of remote/digital tower technology for vertiport infrastructure. The AAM service model is expected to leverage smaller airports, so implementing remote towers at those airports can support development of technology and procedures for more robust utilization of this proven technology.

2 "Saab r-TWR™ Handbook: Your Airport, Our Solutions," Saab, 2023. 7. https://www.saab.com/globalassets/products/ips/saab-digital-air-traffic-solutions/r-twr-handbook-2023.pdf (15 Apr. 2025).

The challenge in the United States is that the Federal Aviation Administration (FAA) in recent years has been unenthusiastic and inconsistent about remote/digital tower technology. Congress has attempted to spur the agency to act, although progress to date has been minimal. This brief makes the case for embracing remote/digital towers in the United States. Part 2 discusses FAA's original research into remote tower technology. Part 3 surveys the global success of remote/digital towers. Part 4 discusses remote tower development in the United States. And Part 5 concludes with recommendations for policymakers.

PART 2

ORIGINAL FAA RESEARCH INTO REMOTE TOWERS

Two decades ago, FAA developed the initial concept of remote/digital tower, in what it called a “staffed virtual tower” (SVT). Analysis of simulations by FAA at its Atlantic City Technical Center was published in the winter 2008 issue of the *Journal of Air Traffic Control*.[3] This initial study demonstrated that an SVT could provide better surveillance at all hours, but especially at night and in low-visibility conditions necessitating instrument flight rules (IFR) (rain, fog, low cloud ceiling, or snow conditions) thanks to use of radar and high-resolution display screens already in wide usage in control towers.

One important finding was that radio communications during “out-the-window” (OTW) simulations of IFR conditions were significantly higher than in the SVT simulations, since in OTW, controllers must rely solely on pilot reports for aircraft location. With SVT technology, controllers can “see” the aircraft position on the display screen. The study also measured increased controller workload for the traditional OTW work environment versus the simulated SVT environment.

After using both alternatives, experienced controllers who participated in the test preferred the SVT displays to conventional OTW operations. The report concluded that the SVT has

[3] Daniel Hannon, et al., “Feasibility Evaluation of a Staffed Virtual Tower,” *Journal of Air Traffic Control*, Vol. 50, No. 1, Winter 2008.

"clear advantages" in night conditions. While most of the discussion in the United States about remote towers focuses on applications at smaller airports, this study was conducted based on Tampa International Airport, showing promising use cases for larger, higher-volume airports.

In 2013, the Human Factors Branch of FAA's Technical Center released a study on "Staffed NextGen Towers" (SNTs) in which controllers would shift from relying primarily on OTW views to camera and surveillance display screens.[4] It concluded that "controllers can perform their jobs effectively in both Supplemental and Contingency SNT environments."[5] Following the tests, which simulated the Dallas-Fort Worth airspace and airport, "controllers felt the cameras were less critical or important in the Supplemental condition, [but] the controllers rated the camera to be essential in both conditions. They also believed that the SNT concept would be beneficial for the [National Airspace System] and for control tower operations."[6]

FAA is currently conducting a study of digital tower operations at its Atlantic City Technical Center utilizing technology provided by a partnership of RTX (formerly Raytheon) and Frequentis, an Austrian air traffic technology developer. This project is discussed in more detail in Part 4.

4 Ferne Friedman-Berg and Nicole Racine, "Staffed NextGen Tower Human-in-the-Loop 2 (SNT HITL 2): Camera Integration Evaluation," Federal Aviation Administration, DOT/FAA/TC-13/41, Apr. 2013.
5 Ibid. 64.
6 Ibid.

PART 3

THE GLOBAL SUCCESS OF REMOTE TOWERS

3.1 FROM NOVELTY TO MAINSTREAM

Remote/digital tower technology is in wide use in Europe and is rapidly expanding to Asia, Canada, and the Middle East. Air navigation service providers (ANSPs) in Germany, Norway, and Sweden are now controlling multiple small airports from a single remote tower center (RTC). RTCs are facilities where multiple airports' airfield operations are managed from one building. Controllers obtain certifications for multiple airports but only work one airport at a time. Remote towers monitoring a single airport are also on the rise. For larger airports, these can be helpful where there is insufficient space to build a new control tower while ensuring full visibility of multiple or long taxiway/runway systems.

Sweden was the first adopter of this technology. As a result, it has the most RTCs and until recently the most remote towers (until being surpassed by Norway) in operation of any country. The first remote tower system to receive regulatory approval was the Saab r-TWR.[7] Sweden has two RTCs in operation that collectively control eight airports, with additional airport additions planned.[8] The number of airports managed from a single RTC will grow over time as towers age and need rehabilitation or replacement. Saab's RTCs are

7 "Saab r-TWR™ Handbook: Your Airport, Our Solutions," Saab. 10.
8 Email to Ginger Evans from Saab Group, 21 Apr. 2025.

dimensioned to support up to 24 airports of different sizes. For instance, the Saab RTC installations in Belgium and the Netherlands will manage between six and 10 airports each.[9]

Remote/digital tower technology is in wide use in Europe and is rapidly expanding to Asia, Canada, and the Middle East.

Globally, remote/digital towers are no longer considered new technology and are increasingly mainstream. The Saab installation in Sweden has had over 14,000 international visitors. On April 4, 2023, members of the U.S. House Committee on Transportation and Infrastructure received a tour and briefing. The delegation included Chairman Sam Graves, Ranking Member Rick Larsen, and six other members.[10]

Outside of Europe, Singapore is issuing a tender for an Intelligent Digital Tower solution (combining advanced surface movement guidance and control system and digital tower). This will be the first in the world to implement a complete digital solution for a large, complex airport.[11]

The major expansion of Dubai's Al Maktoum International Airport is set to incorporate a digital tower solution, rather than a traditional tower, for the planned second control tower in the center of the airfield.[12] In June 2024, Kongsberg Geospatial announced an agreement to provide "digital tower solutions" to Nav Canada, the world's second largest (by traffic) ANSP.[13] The initial facility will be installed to serve Kingston Airport, which will be designed to potentially serve as an RTC to manage additional airports in the future. In

9 Ibid.

10 Telephone call between Ginger Evans, Dr. Phil Smith, and Saab CEO, 27 Aug. 2024. "Expenditure Reports Concerning Official Foreign Travel," U.S. House of Representatives, 12 Oct. 2023. https://disclosures-clerk.house.gov/foreign-reports/2023q4oct12.pdf (21 Apr. 2025).

11 Email to Ginger Evans from Saab Group, 16 Feb. 2025.

12 Ibid.

13 Press Release, "NAV CANADA selects Kongsberg Geospatial as the technology partner to equip Digital Aerodrome Air Traffic Services (DAATS) program," Kongsberg Geospatial, 24 June 2024. https://www.kongsberggeospatial.com/news/nav-canada-selects-kongsberg-geospatial-as-the-technology-partner-to-equip-digital-aerodrome-air-traffic-services-daats-program (15 Apr. 2025).

2025, Thailand plans to begin implementing digital tower solutions across the country's airports.[14]

> *The growing popularity of remote towers around the world is borne out in international surveys.*

The growing popularity of remote towers around the world is borne out in international surveys. According to a database maintained by the International Federation of Air Traffic Controllers' Associations (IFATCA), there were 41 remote towers in operation, under development, or in active planning around the world; 10 remote tower centers; four contingency towers, which are designed to be used when the main tower is out of service for any reason; and five remote tower research sites.[15] While incomplete, IFATCA's database shows the broad interest and success of remote/digital tower technology around the world. Table 1 displays the remote/digital tower projects listed in the IFATCA database by type and country.

TABLE 1: GLOBAL REMOTE/DIGITAL TOWER PROJECTS, BY TYPE AND COUNTRY

Country	Remote Tower	Remote Tower Center	Contingency Tower	Remote Tower Research Site
Australia			1	
Belgium	2			
Canada	1			1
Denmark		1		
Estonia		1		
Finland	7	1		
Germany	3	2		
Hungary			1	
Iceland	1			
Italy	1			

14 "Thailand unveils $106M investment in aviation technology," VNExpress International, 4 Mar. 2025. https://e.vnexpress.net/news/news/traffic/thailand-unveils-106m-investment-in-aviation-technology-4856897.html (15 Apr. 2025).

15 "Remote Towers – Interactive Map," International Federation of Air Traffic Controllers' Associations, 12 Sept. 2023. https://ifatca.org/remote-towers-interactive-map/ (15 Apr. 2025).

Country	Remote Tower	Remote Tower Center	Contingency Tower	Remote Tower Research Site
Japan				1
Netherlands	2			
Norway	14	1		
Romania	1	1		
Singapore			1	
Sweden	8	2		
United Kingdom	1	1	1	1
United States				2
Global	**41**	**10**	**4**	**5**

Source: "Remote Towers – Interactive Map," International Federation of Air Traffic Controllers' Associations, 12 Sept. 2023.

3.2 STAFF AND COST EFFICIENCIES

Saab reports that staffing efficiency was improved by 30% after adoption of centralized operations within remote tower centers (RTCs).[16] These efficiencies can be realized through several pathways. First, RTCs need only one manager per shift, instead of one for each airport. Second, controller coverage can be optimized to avoid disruptions caused by relief time, sick leave, and other variables that influence controller availability. Third, training is conducted on simulators collocated at the RTCs, so controllers do not need to travel for training. Finally, for night operations, when a minimum of two controllers is required (including by FAA), the centralized facility makes it easier to ensure the necessary controller redundancy is achieved.

With respect to capital costs, the cost range for the technology itself is $3 million to $4 million.[17] Once the approval process is streamlined, it is believed these costs can be reduced. Structure or facility costs are in addition to the technology procurement, although these are minimal compared to conventional towers. In some cases, existing facilities can be retrofitted for digital tower operations by adding fiber and communications connectivity.

Total capital costs to deploy a remote tower can be expected to be a fraction of the capital costs experienced by the FAA Contract Tower Program (FCT) in recent years. For instance, in

16 Telephone call between Ginger Evans, Dr. Phil Smith, and Saab CEO, 27 Aug. 2024.
17 Ibid.

FY 2024, FAA awarded Orlando Kissimmee Gateway Airport $1 million to fund the design of a 115-foot FCT replacement tower that is estimated to cost $17 million.[18]

> *Total capital costs to deploy a remote tower can be expected to be a fraction of the capital costs experienced by the FAA Contract Tower Program (FCT) in recent years.*

In the United States, conventional towers operated by FAA can cost between $30 million and $100 million to build, depending on the location, height, and instrumentation. For example, the new 157-foot tower at Teterboro Airport in New Jersey dedicated in 2024 cost $73.4 million.[19] For comparison, the new 370-foot tower at Charlotte Douglas International dedicated in 2022 cost $94 million.[20]

3.3 REMOTE TOWERS IN OPERATION

In 2021, London City Airport became the first major airport to be served by a remote tower.[21] The control facility is located at Swanwick, about 80 miles away.[22] While most airports served by a remote tower are small, interest is growing among larger airports. Table 2 lists remote towers known to be in current operation, which is based on the IFATCA database, a similar database from Think Research,[23] and the authors' analysis.

18 "Kissimmee Gateway Airport Air Traffic Control Tower," Permitting Dashboard, General Services Administration. https://www.permits.performance.gov/permitting-project/dot-projects/kissimmee-gateway-airport-air-traffic-control-tower (21 Apr. 2025).

19 Press Release, "FAA Commissions New Air Traffic Control Tower at Teterboro Airport," Federal Aviation Administration, 20 Jan. 2025. https://www.faa.gov/newsroom/faa-commissions-new-air-traffic-control-tower-teterboro-airport (21 Apr. 2025).

20 Press Release, "FAA Commissions New Air Traffic Control Tower at Charlotte Douglas International Airport," Federal Aviation Administration, 5 Apr. 2022. https://www.faa.gov/newsroom/faa-commissions-new-air-traffic-control-tower-charlotte-douglas-international-airport (21 Apr. 2025).

21 Press Release, "London City is first major airport controlled by remote digital tower," NATS, 30 Apr. 2021. https://www.nats.aero/news/london-city-is-first-major-airport-controlled-by-remote-digital-tower/ (15 Apr. 2025).

22 Ibid.

23 "Remote and Digital Tower Operations," Think Research, 2024. https://think.aero/insights/resources/remote-and-digital-tower-operations/ (15 Apr. 2025).

TABLE 2: REMOTE TOWERS IN CIVIL AVIATION OPERATION

Country	Location	ICAO Code	Year Operational
Germany	Erfurt–Weimar Airport	EDDE	2022
Germany	Saarbrücken Airport	EDDR	2018
Estonia	Kuressaare Airport	EEKE	2024
Estonia	Tartu Airport	EETU	2023
Italy	Brindisi Airport	LIBR	2022
Norway	Berlevåg Airport	ENBV	2020
Norway	Førde Airport	ENBL	2023
Norway	Hasvik Airport	ENHK	2020
Norway	Leknes Airport	ENLK	2025
Norway	Mehamn Airport	ENMH	2022
Norway	Molde Airport	ENML	2025
Norway	Namsos Airport	ENNM	2022
Norway	Røros Airport	ENRO	2022
Norway	Rørvik Airport	ENRM	2022
Norway	Røst Airport	ENRS	2019
Norway	Sandnessjøen Airport	ENST	2025
Norway	Sogndal Airport	ENSG	2023
Norway	Svolvær Airport	ENSH	2023
Norway	Vardø Airport	ENSS	2020
Romania	Brașov-Ghimbav International Airport	LRBV	2023
Sweden	Åre Östersund Airport	ESNZ	2021
Sweden	Kiruna Airport	ESNQ	2021
Sweden	Linköping/Saab Airport	ESSL	2019
Sweden	Malmö Airport	ESMS	2024
Sweden	Örnsköldsvik Airport	ESNO	2015
Sweden	Scandinavian Mountains Airport	ESKS	2019
Sweden	Sundsvall-Timrå Airport	ESNN	2017
Sweden	Umeå Airport	ESNU	2023
United Kingdom	Cranfield Airport	EGTC	2018
United Kingdom	London City Airport	EGLC	2021

Source: "Remote Towers – Interactive Map," International Federation of Air Traffic Controllers' Associations, 12 Sept. 2023; "Remote and Digital Tower Operations," Think Research, 2024; authors' analysis.

Belgium, Denmark, and Norway have aggressive deployment plans to expand remote towers throughout their respective countries. Other countries throughout the world are conducting feasibility studies.

3.4 REMOTE TOWER CENTERS IN OPERATION

The efficiency benefits of remote/digital towers are fully realized under the remote tower center (RTC) model, whereby a single RTC manages air traffic at multiple airports. Unsurprisingly, the early adopters of remote/digital tower technology in northern Europe are leading the development of RTCs. Table 3 lists remote tower centers known to be in current operation, which is based on the IFATCA and Think Research databases, and the authors' analysis.

TABLE 3: REMOTE TOWER CENTERS IN CIVIL AVIATION OPERATION

Country	Remote Tower Center	Airports Controlled (ICAO Code)	Year Operational
Germany	Leipzig	Erfurt–Weimar (EDDE), Saarbrücken (EDDR)	2018
Norway	Bodø	Berlevåg (ENBV), Førde (ENBL), Hasvik (ENHK), Leknes (ENLK), Mehamn (ENMH), Molde (ENML), Namsos (ENNM), Røros (ENRO), Rørvik (ENRM), Røst (ENRS), Sandnessjøen (ENST), Sogndal (ENSG), Svolvær (ENSH), Vardø (ENSS)	2022
Romania	Arad	Brașov-Ghimbav (LRBV)	2023
Sweden	Stockholm	Åre Östersund (ESNZ), Kiruna (ESNQ), Malmö (ESMS), Umeå (ESNU)	2021
Sweden	Sundsvall	Linköping/Saab (ESSL), Örnsköldsvik (ESNO), Scandinavian Mountains (ESKS), Sundsvall–Timrå (ESNN)	2015
United Kingdom	Swanwick	London City (EGLC)	2021

Source: "Remote Towers – Interactive Map," International Federation of Air Traffic Controllers' Associations, 12 Sept. 2023; "Remote and Digital Tower Operations," Think Research, 2024; authors' analysis.

Several countries are planning new or expanded RTCs, most notably Norway. In July 2024, Kongsberg Defence & Aerospace announced an agreement with Norwegian ANSP Avinor to add seven more digital towers at small airports to be managed from Avinor's RTC in Bodø.[24] There are currently 14 remote towers in operation that are managed from Bodø RTC.[25] With the additional seven remote towers by 2027, the number of towers controlled from the RTC

24 Press Release, "To deliver remote towers to seven new Norwegian airports," Kongsberg Defence & Aerospace, 3 July 2024. https://www.kongsberg.com/newsroom/news-archive/2024/kongsberg-to-deliver-remote-towers-to-seven-new-norwegian-airports/ (15 Apr. 2024).

25 André Orban, "Three more airports join World's largest remote tower centre in Bodø, Norway," Aviation24.be, 10 Apr. 2025. https://www.aviation24.be/air-traffic-control/three-more-airports-join-worlds-largest-remote-tower-centre-in-bodo-norway/ (21 Apr. 2025).

in Bodø will increase to 21.[26] These upgrades will cement Bodø center's status as the largest RTC in the world.

Avinor's motivation to greatly expand its remote tower footprint is understandable. Many of the control towers in Norway need renovation or complete replacement. With remote towers, Avinor can avoid significant capital costs associated with building tall concrete control towers. Controllers can handle traffic at multiple airports from the same location. This offers significant efficiency improvements and lower expenses, which in turn will ensure high-quality air transportation in Norway. Importantly, Avinor notes that, from a regulatory perspective, "Remote towers are required to provide a service which is at least as safe or is even safer than the present service."[27]

In April 2025, Italy's ANSP ENAV announced it will convert the control centers at Brindisi and Padua into RTCs to manage 16 low-traffic airports.[28] According to ENAV's strategic plan, the ANSP aims to increase airports managed from these RTCs to 26 by 2033.

Another notable RTC project was announced in April 2024, when Belgian ANSP Skeyes launched its Digital Tower Test Center in Steenokkerzeel.[29] It is a prototype for the RTC being set up by Skeyes and the Walloon airport operator in Namur. By 2026, air traffic at both Charleroi and Liege airports will be managed by the new center in Namur. The Namur RTC will be responsible for air and ground traffic at both airports.

[26] "Remote Towers," Avinor. https://avinor.no/en/avinor-air-navigations-services/services/remote-towers/ (15 Apr. 2025).
[27] Ibid.
[28] Press Release, "Strategic Plan 2025-2029. Innovation, sustainability and growth for the future of air transport," ENAV, 1 Apr. 2025. https://www.enav.it/en/node/18361 (23 Apr. 2025).
[29] Press Release, "Launch of Digital Tower Test Centre by skeyes," Skeyes, 25 Apr. 2024. https://press.skeyes.be/launch-of-digital-tower-test-centre-by-skeyes-fumqca (15 Apr. 2025).

PART 4

REMOTE TOWER DEVELOPMENTS IN THE UNITED STATES

The idea for remote towers originated in the United States when FAA conducted initial tests at the Atlantic City Technical Center in 2007, as is discussed in Part 2. Air traffic controllers delivered positive feedback on the excellent visibility provided by displays, especially during night and in low-visibility meteorological conditions.[30]

FAA's 2013 Staffed NextGen Tower report stated the agency hoped to realize operational benefits from "shifting from a model of control that relies on the [out-the-window] view to one that relies on surveillance displays," including "increase[ing] capacity at night or during periods of inclement weather when impaired visual observations might otherwise lead to delays or reduced airport access levels" and "enable[ing] controllers to perform remote operations from a ground-level facility for contingency operations."[31]

FAA's enthusiasm was warranted. In the United States, additions to the FAA Contract Tower Program or tower replacements are sometimes slowed or halted due to the controller staffing deficit or budget considerations. Some smaller airports lack air traffic control

30 Daniel Hannon, et al., "Feasibility Evaluation of a Staffed Virtual Tower."

31 Ferne Friedman-Berg and Nicole Racine, "Staffed NextGen Tower Human-in-the-Loop 2 (SNT HITL 2): Camera Integration Evaluation." 1.

towers, which deny them the safety and commercial benefits of tower services. Remote towers offer a budget-conscious alternative to address these situations.

"Some smaller airports lack air traffic control towers, which deny them the safety and commercial benefits of tower services. Remote towers offer a budget-conscious alternative to address these situations."

Two remote tower pilot projects were initiated by the states in the previous decade, one in Leesburg, Virginia, and the other at Loveland, Colorado, near Fort Collins. Both projects were funded by a combination of state funds and private investment, not by the FAA.[32]

In November 2021, the FAA issued an "operational viability decision" on the Saab Remote Tower System at Leesburg, authorizing it to continue managing traffic without a backup mobile tower.[33] This was not official certification, but it did trigger the type certification process between Saab and the FAA, which would allow the Leesburg remote tower to be approved as a non-federal system within the National Airspace System. Congress included $4.9 million in FY 2022 appropriations to fund contract controllers for type certification at Leesburg, as well as fund operational viability testing at Fort Collins.[34]

However, in February 2023, the FAA announced it would terminate the Leesburg remote tower's operations on June 14.[35] Saab had sent a letter to the FAA in 2022 announcing that it was pulling out of the project after nine years. The company told *The Washington Post* that it "determined there is no reasonable path for approval" under the FAA's shifting certification requirements.[36] The FAA's primary internal advocate of the technology, its former vice president of air traffic services, had also been reassigned to another role within the agency in 2022.

[32] Robert Poole, "Remote Towers: Europe Many, U.S. Zero," *Aviation Policy News*, 21 May 2021.
[33] Robert Poole, "More on FAA and Remote Towers," *Aviation Policy News*, 22 Nov. 2021.
[34] Consolidated Appropriations Act, 2022, Joint Explanatory Statement Division L, 168 Cong. Rec. H3032, Mar. 2022.
[35] Robert Poole, "Is FAA Giving Up on Remote Towers?" *Aviation Policy News*, 23 Mar. 2023.
[36] Lori Aratani, "This air traffic control system helped to grow flights. Now it's being shut down." *The Washington Post*, 11 Apr. 2023.

Following the news out of Leesburg, it was reported that the Fort Collins remote tower project was "on life support."[37] Vendor Searidge pulled out of the Colorado tower project in October 2023. The local project sponsors have brought in RTX (formerly Raytheon) and Frequentis in an attempt to salvage progress made to date and complete system design approval, but FAA is no longer supporting the project.[38]

These latest setbacks suggest the FAA bureaucracy is resistant to remote and digital tower technology. The FAA Reauthorization Act of 2024 included provisions in Section 621 aimed at addressing the FAA impasse on remote/digital towers.[39]

First, the law requires FAA to create a clearly defined system design and operational approval process, and to publish milestones for achieving testing and deployment approval, within 180 days of enactment on May 16, 2024.[40] The lack of clear formal standards and FAA's ad hoc approach to system design approval bedeviled airport sponsors and technology vendors, and deterred interest in remote/digital towers in the United States. This provision would also require FAA to "assess the safety benefits of a remote tower against the lack of an existing tower,"[41] which will hopefully help the agency better understand the risks and costs that arise from inaction.

> *Sec. 621 partially reverses a 2022 FAA decision to force vendors to install their systems at the FAA Technical Center in Atlantic City, New Jersey for evaluation rather than allow those systems to be evaluated at the airports at which they would be operated, a costly deviation from international best practices.*

[37] David Hughes, "Colorado Airport's Remote Tower on Life Support," *Aviation International News*, 11 Apr. 2023.
[38] Bill Carey, "Colorado Advances Digital Tower Effort Dropped by FAA," *Aviation Week*, 6 Mar. 2024.
[39] FAA Reauthorization Act of 2024, Pub. L. 118–63, 138 Stat. 1235, 16 May 2024. § 621.
[40] 49 U.S.C. § 47124(h)(1).
[41] 49 U.S.C. § 47124(h)(2)(E).

Second, Sec. 621 partially reverses a 2022 FAA decision to force vendors to install their systems at the FAA Technical Center in Atlantic City, New Jersey for evaluation rather than allow those systems to be evaluated at the airports at which they would be operated, a costly deviation from international best practices. Specifically, the law requires that FAA expand system design approval to at least three locations outside the Technical Center by the end of 2024.[42]

Third, despite the many setbacks, the new law recognizes the significant progress made toward achieving system design approval by Northern Colorado's project, and that forcing it to restart from square-one under the new mandated process would be cost-prohibitive. To that end, Sec. 621 states that FAA should not interpret anything in the new law as invalidating prior system design approval activity and that existing work toward this goal should be preserved.[43]

Fourth, to allow for better congressional oversight of FAA's efforts to implement the new remote tower law, Sec. 621 requires the FAA to brief legislators within 180 days of enactment and every six months thereafter through September 2028.[44] These regular briefings should help bring needed transparency to FAA's work on remote towers, where opaqueness was a common complaint among external stakeholders.

> *Despite the new directives from Congress, FAA has to date made minimal progress toward complying with the law.*

Finally, the law amends the FAA Contract Tower Program's and Contract Tower Cost Share Program's enabling statutes to explicitly add eligibility for remote towers.[45] This provision aims to level the playing field between conventional brick-and-mortar towers and remote towers. These changes should both increase the ability of small airports to add tower service and reduce per-airport expenses through lower-cost remote towers. Sec. 621 also orders FAA to prioritize testing and deployment of remote towers at those airports that

42 49 U.S.C. § 47124(h)(3).
43 49 U.S.C. § 47124(h)(4).
44 FAA Reauthorization Act of 2024. § 621(b).
45 Ibid. § 621(c).

currently lack air traffic control towers, wish to provide small and rural community air service, or are new entrants into the Contract Tower Program.[46]

Despite the new directives from Congress, FAA has to date made minimal progress toward complying with the law. The deadline for FAA to submit its comprehensive plan to Congress was November 12, 2024. No plan has been issued to date, but FAA is currently evaluating the Colorado-sponsored RTX/Frequentis remote tower system at its Atlantic City Technical Center. Internal FAA documents obtained by Reason Foundation state, "For a system to become operational in the [National Airspace System], the vendor system must obtain [system design approval] at the Tech Center," which shows FAA has not made progress in expanding this process to at least three airports outside the Technical Center as required by Congress.[47] FAA also indicated that its sudden publication of new draft technical requirements in June 2024 delayed the RTX/Frequentis installation at the Tech Center by at least four months.

Optimistic observers anticipate that FAA will issue system design approval (SDA) for the RTX/Frequentis system by spring 2026. The SDA should specify which runway configurations can utilize this technology. Some jurisdictions are preparing to submit applications to enter FAA's remote tower program once the SDA is published, which is viewed as an indicator of FAA's support for the underlying technology. Importantly, these jurisdictions may be able to leverage new 2024 FAA reauthorization provisions, such as the requirement that FAA allow the SDA process to take place at no fewer than three airports outside the Atlantic City Technical Center.

46 49 U.S.C. § 47124(h)(5).
47 Marc Scribner, "FAA Misses Congressional Targets on Remote/Digital Towers," *Aviation Policy News*, 24 Feb. 2025.

PART 5

CONCLUSION AND RECOMMENDATIONS

Remote tower technology has been proven and can provide air traffic control services to several small airports from a single facility. A controller would monitor and direct traffic at only one airport at a time but would be certified for several aerodromes. This would make more productive use of available controllers, allow redundant staffing during low-traffic periods, and allow for consolidated facilities to be located in areas desirable to current controllers and new hires. Compared to new or replacement conventional control towers, there are significant capital and operating cost advantages.

A secondary but important benefit is that successful implementation of remote tower centers would be an important step in providing additional digital technology and services for air traffic facilities throughout the National Airspace System (NAS). Digitalization is key to continuing improvements in system efficiency and communication with NAS users. Internationally, air navigation service providers are developing additional uses for this technology, including at very large airports.

FAA is sensitive to ongoing criticism about the technological advances and deployments made by other air navigation service providers and often emphasizes the higher complexity of the U.S. NAS. While it is true that the United States has some of the most congested and complex activity near major metropolitan areas, dozens of small U.S. airports have relatively simple, low-volume operations that can benefit from this technology.

Many advancements that FAA needs to make are complex and must be done carefully and step by step. Deploying remote/digital tower technology, initially at small U.S. airports, is a logical starting place. The technology is proven, and successful procedures have been published and deployed for nearly a decade. As with the prior FAA tests using virtual tower equipment, once anyone (especially controllers, but even laypeople) sees an installation, they realize that this technology can provide significant support to air traffic controllers and to the National Airspace System writ large.

FAA senior management should have a technology plan for remote/digital towers and remote tower centers that envisions the logical next steps in a rollout in the NAS. To facilitate a holistic view of the possibilities, FAA staff should conduct site visits to remote tower centers in Norway and Sweden. FAA staff should also review the simulations of the planned digital tower deployments at Singapore and Al Maktoum airports. To advance near-term deployment in the United States, FAA should consider:

- Developing a new remote tower center to manage multiple small airports;
- Testing and certification of multiple technology vendors;
- Conducting field pilots, including system design approval, at sponsor airports as contemplated in the FAA Reauthorization Act of 2024; and
- Reviewing European Union standards for (partial) applicability in the United States.

FAA is on a path to support the development of remote towers, and these efforts should be finalized and standards issued as soon as practicable. Congress should continue its encouragement and oversight to ensure FAA remains on this path to success. Ongoing attention on air traffic control modernization from the Office of the Secretary at the U.S. Department of Transportation should be sustained, with a particular focus on the near-term benefits that could be realized from proven remote tower technology.

ABOUT THE AUTHORS

Ginger Evans is a nationally recognized leader in transportation and technology innovation. She managed two of the nation's top performing airports, Denver International and O'Hare/ Midway International Airports, and served as vice president of engineering for Metropolitan Washington Airports Authority. In the private sector, she managed airport capital programs at 15 U.S. airports, two Canadian airports, as well as airports in Lisbon, Quito, Mexico City, Hamad International, Abu Dhabi, and Al Duqqam. Her experience with transit projects includes the Dulles Silver Line, MTA Oversight, MIA Mover, DIA light rail station, and the HIA Doppelmayr.

For JFK New Terminal One, Evans negotiated a groundbreaking Master Systems Integration agreement with top airport systems providers that will support operations with the highest levels of customer service, sustainability performance, efficient operating expenses, and business intelligence. Following the onset of the COVID-19 pandemic, Carlyle Airport Group organized the AAAE Airport Consortium on Consumer Trust (ACT), an industry response to develop and share best practices. She developed ACT working groups to perform pilot projects and publish white papers in support of overall industry recovery and improved operations.

Evans is an *ex officio* member of the Executive Committee of Transportation Research Board and is one of only two industry leaders recognized twice by *Engineering News-Record* for a leading contribution to the industry (1994 for Denver International and 2019 for O'Hare International). She has served as advisor to two private equity funds in Mexico for over 10 years. In 2022, she was given the Award of Excellence from the Airport Consultants Council. She also serves as the chief strategy officer for Carlyle Airport Group, based in Washington, D.C.

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Scribner has testified numerous times before Congress at the invitation of both Democrats and Republicans on issues including highway revenue collection, traffic congestion management, public transit productivity, freight rail regulation, airport financing, and air traffic control modernization. He is a member of the Transportation Research Board's Standing Committee on Emerging Technology Law.

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