a3i Next Wave™ · No. 2 · November 2026

Your Airport Already Has the Data for an AI Digital Twin

What FAA programs already give airports, what the rules still won't fund, and how a twin can scale across the NPIAS

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November 6, 2026 ·



Figure 1. NASA's FutureFlight Central at Ames Research Center, a full-scale virtual airport control tower jointly funded by NASA and the FAA, at its opening in December 1999. Photo: NASA / Wikimedia Commons (public domain). “In my first year as a program manager supporting NASA Ames, as a contractor, FutureFlight Central was one of the simulation facilities I was responsible for.” —Richard S. Walsh

A generational shift is underway, and the national airport system has to prepare for it. New aircraft, artificial intelligence and new ways of using airports are only the beginning.

New uses need new revenue models, and new revenue models need regulatory change. Twice a month, a3i Next Wave™ looks at where the system is ready, where it still runs on legacy rules, and what it will take to close the gap.

Abstract and key findings

A digital twin is a virtual model of an airport, kept current with live data, that planners and operators can use to test a decision before they make it. This edition argues that most NPIAS airports already hold the foundation for one in records they keep for the FAA, and it maps what is still missing in funding, standards and data access.

- The base layers already exist: airport GIS survey data, the Form 5010 master record, the Terminal Area Forecast and FAA's SWIM flight and surface feeds, for which FAA says "there is no cost for data."
- AIP will not fund a stand-alone operational twin. Software costs count only while tied to an approved project, and "ongoing data subscription services" are not allowable.
- No FAA advisory circular defines an airport digital twin, and FAA's public cloud feed may not be used for purposes that affect the National Airspace System.
- A twin can start small. A nonprimary airport can build a planning twin from its own records, and a large hub can add sensors and machine learning.
- Regulatory Corner: the AIP software rule was written for consultants' project software, not for a living model of the airport. We propose a "digital infrastructure planning" eligibility line.

1. The opportunity: the data is already on file

The Airport Cooperative Research Program (ACRP) describes digital twins as "detailed virtual representations of a facility or system kept up-to-date with real-time data."[1] Its project 03-66, *Guidebook for Digital Twin Programs at Airports*, set out to produce a guidebook and roadmap that "should be scalable to airports of all sizes." TRB lists the $350,000 project, led by InterVISTAS, as complete, with work ending in November 2024.[2]

The term suggests a large hub with a large technology budget. Much of the foundation, however, is data that airports already maintain for the FAA:

- **Airport geography.** AC 150/5300-18B sets the standards for airport survey and GIS data submitted to FAA,[3] and Engineering Policy Memo 25-01 (May 16, 2025) updated when those surveys, including Safety-Critical Data, are required on federally funded projects.[4] AC 150/5300-19 describes Airports GIS as "the designated repository for authoritative data describing the physical infrastructure, characteristics, services, and operational environment of the nation's airports."[5]

- **The airport's basic facts.** The same advisory circular says the Airport Master Record, FAA Form 5010, "describes the basic operational and services data of the airport."[5] Those records are public through FAA's Airport Data and Information Portal.[6]

- **Demand.** The Terminal Area Forecast is the official FAA forecast of aviation activity for U.S. airports and covers active NPIAS airports.[7]

- **Live traffic.** FAA's System Wide Information Management (SWIM) program lists airports among its consumers and names "airport surface information, accurate flight tracking, and digital Notices to Airmen (NOTAMs)" among the data driving demand. "Currently there is no cost for data," FAA says; the consumer pays to build its own interface, and on-ramping typically takes two to six months.[8] Its cloud service, SCDS, is "publicly accessible."[9] Behind the tracking data sits the ADS-B Out equipment that aircraft have needed since January 1, 2020, in Class A, B and C airspace and other specified airspace.[10]

  Add the sponsor's own records, such as leases, work orders, utility meters and budgets, and an airport has the inputs for a first-generation planning twin. That is a3i's assessment, and it is the case my 2026 NPIAS paper makes (see Section 12).

  Why now. The people who will use and staff airports over the next decade grew up with live data in their pockets. Pew Research Center's 2026 survey found that 97 percent of U.S. adults ages 18 to 29 own a smartphone, and that 24 percent of that age group are smartphone-dependent, with no home broadband.[11] On the workforce side, FAA hired a record 2,235 air traffic controller trainees in fiscal year 2026, after a recruiting campaign aimed at gamers drew more than 12,000 qualified applicants in 24 hours.[12] Our judgment, not a survey finding, is that travelers who track a ride to the curb in real time will expect the airport to know as much about its own operation.

3,287 Airports in the NPIAS, with $67.5 billion in eligible development for 2025–2029 (FAA)	**$0** FAA's stated cost for SWIM data; consumers pay to build their own interface (FAA)
2,897 Nonprimary NPIAS airports: 88% of the system and 1% of enplanements (FAA)	**$150,000** Maximum annual nonprimary entitlement per airport (49 U.S.C. 47114)

Figure 2. Key numbers. Sources in the reference list.

2. The requirements: integration, upkeep, security and people

Data on file is not yet a twin. A working model needs four more things. The first is a common spatial base that every department uses, and the airport's GIS is the natural candidate. The second is a way to keep the model current, through feeds, sensors and the staff time to maintain them. The third is governance for cybersecurity and privacy. The fourth is people who can run it. ACRP's problem statement is plain about the cost: "The development, operation, and maintenance of a digital twin will require a significant investment of resources."[2]

Integration is the hard part. At Pittsburgh International Airport, planning services manager Julia Arnone put it this way to Esri, the airport's GIS software provider: "The first step is integrating all the data across departments." Then, she said, "real-time sensors and machine learning can create a basic digital twin."[13]

3. The airport solution and its benefit

Pittsburgh shows the path from records to a model. According to Esri's case study, the airport lost 90 percent of its flights when it was dehubbed in 2004. Arnone began its GIS work largely on her own, in what she called a "0.25-person operation." The airport has since used GIS and building information modeling across its 8,800-acre campus to verify concession space and to move inspections onto real-time field forms, and it aims to build a comprehensive digital twin "within three to five years."[13] This is the vendor's account, and we have not verified it independently.

Pittsburgh International and Allegheny County Airport (AGC) are both run by the Allegheny County Airport Authority (ACAA). A disclosure: from 1997 to 2000 I served as ACAA's Director of Planning & Environmental Affairs. I have no current relationship with the authority.

The benefits below are a3i's analysis, not measured results:

- **Capital planning.** A sponsor can test a layout change against the Terminal Area Forecast before paying for design.
- **Asset management.** Pavement, lighting and utility records sit on one map, so inspections and work orders stop living in separate spreadsheets.
- **Energy.** AIP now funds airport energy assessments under 49 U.S.C. 47140, including "base load and backup power" needs.[14] Placing the results in the twin puts future eVTOL charging and today's terminal load on the same model.
- **Revenue.** A current model of leasable land and concession space supports non-aeronautical revenue, which is where Pittsburgh's GIS work began.
- **Grants.** Data already kept to FAA standards is easier to reuse in the next application.

4. Applying the idea across the NPIAS

The 2025–2029 NPIAS includes 3,287 airports and $67.5 billion in eligible development.[15] Activity is highly concentrated. The 31 large hubs handle 71 percent of enplanements, while the 2,897 nonprimary airports, 88 percent of the system, handle 1 percent (NPIAS Table 2, p. 4).[15] The federal share of AIP project costs is 75 percent at large and medium hubs and 90 to 95 percent at small primary, reliever and general aviation airports.[16] A nonprimary airport's annual entitlement is the lesser of $150,000 or one-fifth of its five-year NPIAS development cost.[17]

A twin therefore has to scale. The tiers below are an a3i proposal, built on the scaling approach in my NPIAS paper (Section 12):

NPIAS category	Starting twin (a3i proposal)	Likely funding path
Large and medium hubs (64 airports, 88% of enplanements)	Operational twin: GIS base, SWIM feeds through FAA's operational gateway where NAS-impacting use is approved, terminal and airside sensors, machine learning	Airport revenue and private partners; AIP only for project-tied pieces
Small hubs and nonhubs (326 airports, 11% of enplanements)	Planning and asset twin with public SWIM feeds for non-operational analysis	AIP for GIS surveys, planning and energy assessments; airport revenue for subscriptions
National and regional nonprimary (708 airports)	Planning twin built from GIS, Form 5010, the TAF, and lease and pavement records	Nonprimary entitlement for eligible planning work; state aviation funds
Local, basic and unclassified (2,189 airports)	A shared, state-hosted twin template that each airport fills in	State aviation programs; state block grants in participating states

Under 49 U.S.C. 47128, FAA may run the state block grant program with "not more than 20 qualified States,"[18] so the last tier depends on the state.

5. Standalone vertiports: outside the fence, outside the plan

This is regulatory analysis, not legal advice.

Many vertiports will not sit inside an airport. They will be on a garage roof downtown, at a hospital or at a corporate campus, owned by the city, a neighboring city or a private company. Those sites start without the two things this edition is about: an airport's data foundation and AIP eligibility.

Federal law defines an "airport" to include a heliport, but the word "vertiport" does not appear in that definition (49 U.S.C. 47102). AIP grants go to "public-use airports," meaning a facility controlled by a public agency, or a private one that is a reliever or has at least 2,500 annual boardings and scheduled passenger service. A private vertiport fails the public-use test. A new city-owned one could not enter the NPIAS today, unless the rule is changed, and so it typically lacks a 5010 record, a Terminal Area Forecast and an AIP-funded GIS survey.

Even an airport sponsor that builds its own downtown vertiport cannot count on AIP: eligibility follows the NPIAS site, not the sponsor (47105(b)(2)). Whether such a site could be part of the parent airport is a question FAA has yet to answer. We'd suggest a clear path: Congress adds "vertiport" to 47102 and clarifies eligibility for vertiports owned by NPIAS sponsors. FAA then sets forecast-based NPIAS entry criteria, adds vertiports to its off-airport eligibility list, and updates the airport-revenue and airport-layout-plan grant assurances to cover them.

A sponsor-built vertiport is also an airline question. If its costs reach the airport's operating budget or rate base, signatory carriers would likely have a say under their use-and-lease agreements, as we noted in Curb to Cabin. Some may welcome it: Delta has invested in Joby to build a premium home-to-airport service, and United holds a stake in Archer.

Congress did act on design. Section 958 of the 2024 Reauthorization ordered a performance-based vertiport AC, and FAA's draft AC 150/5390-4 would replace both EB 105A and AC 150/5390-2D. Section 960 extended the AAM infrastructure pilot program to Sept. 30, 2027. Neither section adds vertiports to the NPIAS. Our view is that a dedicated NPIAS designation for AAM is the missing step.

6. Regulatory hurdles, and how to clear them

AIP eligibility. The 2024 reauthorization made advanced digital construction management systems eligible, but FAA's guidance limits them to "when such systems or technologies are acquired to carry out a project approved by the FAA," and says "purchase of these systems for the purpose of operations or maintenance of a facility alone is not eligible." Subscription costs are allowable only during the project and are "no longer allowable once the project is complete." FAA "may prorate eligible costs of an ADCMS that includes additional functionality" where the system provides a net benefit to the airport.[14] The AIP Handbook adds that "The costs of ongoing data subscription services, such as those needed for a noise monitoring program, are not allowable" (para. 3-66).[19] *Solution:* build the twin's base layer inside work AIP already funds, namely the GIS survey, the planning study and the §47140 energy assessment, and add construction-management software within an eligible construction project. Pay ongoing subscriptions from airport revenue.

No standard. We found no FAA advisory circular, engineering brief or standard that defines an airport digital twin or an AI analytics data model. The ACRP guidebook work is voluntary. *Solution:* a3i proposes that FAA or ACRP publish a reference data model that joins the eALP, Form 5010, the TAF and SWIM, scaled by NPIAS category.

Data-access limits. FAA's SCDS guideline says SWIM data from the public cloud service "is not intended for NAS-impacting usage and SHOULD NOT be used as the sole source for any aviation-safety related, law enforcement, or judicial activity," and that users "MUST NOT use the data they obtain for NAS-impacting purposes."[20] *Solution:* use the public feed for planning and analysis, and route any function that would feed operational decisions through FAA's operational connection with FAA approval. Draw that line in the twin's design from the start.

Cybersecurity. Airport cybersecurity projects are eligible in statute under 49 U.S.C. 47102(3)(U), but FAA says "Any future project eligibility will depend upon Committee recommendations and final rulemaking."[14] The Civil Aviation Cybersecurity Aviation Rulemaking Committee published an interim recommendation on August 25, 2026, and its status is listed as open.[21] *Solution:* follow the NIST-based practice the National AAM Strategy already recommends (Section 11), and document the controls so they can be funded when the eligibility takes effect.

AI assurance. FAA's *Roadmap for Artificial Intelligence Safety Assurance* states that its "scope is aligned to FAA authority to promote safe flight of civil aircraft," and that "The use of AI to improve the efficient use of airspace is outside the scope of this roadmap."[22] Airport-side decision tools are not addressed. *Solution:* until guidance exists, keep the twin as decision support, with a named person approving each action it recommends.

NEPA. Software alone usually involves no federal action. A grant, an Airport Layout Plan approval or a land approval does. FAA Order 1050.1G lists categorical exclusions (CATEXs) that fit a twin program. They include the "issuance of grants that do not imply a project commitment, such as airport planning grants" (B-2.1(o)); "accessory on-site structures… and other essentially similar minor development items" (B-2.4(f)), which could cover a small edge-compute enclosure; "the addition of equipment such as telecommunications equipment, on an existing facility where no additional land is required" (B-2.4(n)); and the "installation or replacement of engine generators used in emergencies" (B-2.3(f)).[23] The order states that the office labels on each CATEX are "for reference only," and every CATEX still requires a review for extraordinary circumstances.[23] *Solution:* start with a planning grant, place hardware in existing buildings, and confirm the CATEX with the FAA Airports District Office early.

Clean Air Act. Edge computing needs reliable power, and reliable power often means a diesel generator. In nonattainment and maintenance areas, which sponsors can look up in EPA's Green Book,[24] a federal action needs a General Conformity determination only if its emissions reach the de minimis rates. For ozone precursors, those rates run from 100 tons a year in lower-classified areas outside the ozone transport region down to 10 tons in extreme areas. The portion of an action that requires a new source review or prevention of significant deterioration permit is excluded.[25] EPA's 1995 guidance sets 500 hours a year as the default for estimating an emergency generator's

potential to emit,[26] and federal engine rules allow emergency units up to 100 hours a year for maintenance, testing and limited non-emergency use.[27] *Solution:* a planning twin can run in the cloud or in rooms that already have backup power. If a new generator is needed, size it in the §47140 energy assessment and check the area's status before siting it.

7. Partners

FAA's Airports District Offices decide eligibility and the CATEX, and FAA's SWIM program controls data access. State aviation agencies, represented nationally by NASAO, can host the shared template for small airports and fund what AIP will not. ACRP and TRB hold the research. Software and GIS providers such as Esri supply the platform. Airlines, fixed-base operators and future AAM operators hold the gate, fuel and flight data that make the model current, and utilities hold the load data an energy model needs. The National AAM Strategy's Recommendation 7.6 calls on government to "Leverage Public-Private Partnerships and other appropriate structures to facilitate and accelerate investments in, and sustained adoption of, AAM technologies" (p. 50).[28] A data-sharing agreement among these parties may be a twin's most important document.

8. Infrastructure

A planning twin needs little new hardware: the GIS, a cloud workspace and a connection to the public SWIM feed. An operational twin needs more, including fiber across the airfield, sensors in the terminal and on the ramp, edge computing for functions that cannot wait on the cloud, and backup power for all of it. Those are the same conduits, rooms and electrical capacity that eVTOL charging will need. In a3i's view, an airport that runs its §47140 energy assessment and its twin plan together can build that infrastructure once.

9. Public perception

Three concerns will come up, and each has a planning answer. The first is privacy. Terminal sensors and passenger-flow analytics raise fair questions about what is collected and kept. An airport can publish its data inventory and retention rules before installing anything. The second is security, and a sponsor can show its controls against a recognized framework. The third is jobs. In our view, a twin changes how staff work more than whether they are needed. Pittsburgh's effort began with one planner doing much of the GIS work herself, not with a plan to replace staff.[13]

These are a3i's recommendations; we found no public-opinion survey on airport digital twins specifically.

10. Regulatory Corner: legacy rules versus what is needed

	Legacy rule	What is needed (a3i proposal)
Software	AIP Handbook para. 3-66 allows software only "for the duration of the approved AIP project" and bars "ongoing data subscription services."[19]	A defined useful-life and subscription rule for airport data systems
Scope	ADCMS is eligible only to "carry out a project approved by the FAA," not for "operations or maintenance of a facility alone."[14]	Eligibility for data collection, integration and model development that supports capital planning, asset management and resilience
Cyber	47102(3)(U) waits on "Committee recommendations and final rulemaking."[14]	Timely rules, so twin security controls become fundable

The software paragraph was written for a world in which a consultant bought software to finish a study and the project then closed. A digital twin is valuable because it does not close. Congress has expanded the eligible list before: the 2024 Act added both the construction-management and cybersecurity lines. There are three routes. Congress could add a "digital infrastructure planning" line to 49 U.S.C. 47102[29] in the next reauthorization. FAA could treat a twin's planning and asset-management components as planning costs in the final AIP Handbook update; its comment period closed August 31, 2026, and FAA says "A final updated handbook will be available next summer."[30] And once the cybersecurity committee finishes, rulemaking would activate the cyber line. These routes are our analysis, not an FAA position.

11. Tie to the National AAM Strategy

The *National Advanced Air Mobility Strategy* (December 2025) already points toward airport twins:[28]

- **Rec. 1.4 (p. 8)** calls for “information exchange protocols, technology requirements, and security requirements for integrated updates to facilitate free flows of information among providers of air traffic management services,” and describes a network that “facilitates extensive data sharing.”

- **Page 9** states that “establishing performance requirements, data formats, standards, and procedures for data sharing will be critical to ensure consistency and interoperability in AAM and other nearby airspace operations.”

- **Page 42** says “Today’s airspace must be upgraded by leveraging emerging technologies such as autonomy, cloud and edge computing, machine learning, and artificial intelligence.”

- **Page 43** asks for “best practices for safe use of data, competitive protections of intellectual property, and assurance frameworks that establish responsible Artificial Intelligence and Machine Learning concepts.”

- **Rec. 6.2 (p. 43)** directs an assessment of “the feasibility and cost-effectiveness of virtual testing.” It concerns increasingly autonomous aircraft, but an airport twin is the ground-side counterpart.

- **Rec. 3.7 (p. 26)** asks agencies to update Privacy Impact Assessments and to “leverage best practices for cybersecurity in accordance with the National Institute of Standards and Technology (NIST).”

- **Rec. 2.1 (p. 12)** notes “nearly 20,000 total landing facilities in the United States,” a reminder that any data model has to work beyond the hubs.

  Page numbers are the Strategy’s printed page numbers.

12. From the paper

> *“A robust airport enterprise AI framework treats facilities as scalable nodes in a layered NPIAS model, culminating in digital twins, virtual replicas for simulation and optimization. The foundation draws from core datasets: Airport Layout Plans (ALP) for spatial configurations, FAA 5010 master records for operational details, Terminal Area Forecasts (TAF) for demand projections, enterprise financial data for budgeting, and regional/national economic/census information for contextual insights.”*
>
> Richard S. Walsh, *The Evolution of the National Plan of Integrated Airport Systems (NPIAS): Adapting to Generational Shifts and the AI Revolution* (2026), p. 4[31]

13. The takeaway

An airport does not need to start a digital twin from nothing. The geography, the master record, the forecast and the live traffic data are already on file, much of it free. What is missing is a funding line that treats a living model as infrastructure, a reference standard and a clear rule on data use. Sponsors can start now inside eligible projects while making the case for the rule change.

What's your airport doing with its data?

Whether you're updating your Airport Layout Plan, piloting sensors or just trying to get every department working from the same map, I'd like to hear how you're approaching it. Connect with me on LinkedIn and share your story.

Connect on LinkedIn or email r.walsh@a3iglobal.com

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Written with AI tools; the views are my own. This article is general information, not legal advice.

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Links checked November 2, 2026. Pages for the National AAM Strategy are its printed page numbers.