From Certification to Competence

Addressing the "Paper Pilot" Gap in UAS Workforce Education

White Paper
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For Career and Technical Education (CTE) and Postsecondary Workforce Pathways

Abstract

Uncrewed Aircraft Systems (UAS) are increasingly embedded in critical infrastructure inspection, public safety support, energy operations, and logistics. As workforce demand expands, educational institutions face rising expectations to produce graduates who are not only credentialed but operationally competent. FAA Part 107 certification provides an important regulatory knowledge baseline, yet it does not directly assess manual piloting proficiency, situational awareness, or operational judgment in realistic environments. This gap between certification and competence has contributed to the emergence of "Paper Pilots," individuals who hold credentials but cannot reliably perform under operational constraints. For Career and Technical Education (CTE) and postsecondary programs, the Paper Pilot problem creates reputational, safety, and accountability risk. This white paper synthesizes public regulatory guidance and training research to propose a defensible, competence-based approach to UAS workforce preparation emphasizing structured progression, simulation-supported evaluation, and optional third-party benchmarking.

Keywords

UAS workforce education; CTE; Perkins V; FAA Part 107; competency-based training; simulation; performance evaluation; third-party validation; safety culture; Paper Pilots.

Executive Summary

Educational programs preparing students for UAS roles increasingly operate under a workforce standard rather than an enrichment standard. Employers in high-consequence environments require pilots who can execute procedures, maintain situational awareness, and make sound decisions under constraint. FAA Part 107 certification is necessary for many commercial operations and provides a foundational assessment of aeronautical knowledge. However, certification alone does not validate manual piloting skill or operational decision-making under realistic constraints.

This paper defines "Paper Pilots" as individuals who hold relevant credentials but have not developed the manual proficiency, situational awareness, and operational judgment required for real-world UAS operations. The Paper Pilot gap creates institutional risk: graduates who are certified but not trusted by employers, elevated safety exposure during live flight labs, and difficulty defending rigor during funding reviews and audits.

A competence-based approach to UAS workforce preparation emphasizes structured progression, repeatable evaluation environments including simulation, and external benchmarking where appropriate. Simulation enables safe repetition and standardized assessment, especially for judgment and mission planning.

The paper concludes with a conceptual, implementation-agnostic framework institutions can use to move from certification-focused programming to competence-verified programming without prescribing proprietary tools or vendor-specific curricula.

1. Introduction: UAS Workforce Education Has Changed

UAS adoption has shifted from experimentation to operational necessity across multiple sectors. Drones now support tasks such as linear infrastructure inspection, damage assessment, mapping, and situational awareness for emergency response. As operational use cases mature, workforce expectations increasingly resemble aviation and technical trades: competence is measured by performance and reliability, not only by test results.

For educational institutions, this shift changes what it means to offer a drone program. In earlier market conditions, programs could emphasize exposure and enrichment outcomes. Today, especially in high school CTE and junior college settings, stakeholders increasingly expect employability and workforce readiness Outcomes.

The central challenge is that the most visible credential in the drone ecosystem, the FAA Part 107 Remote Pilot Certificate, is frequently interpreted as a proxy for operational readiness. Part 107 establishes regulatory knowledge and compliance expectations. It is not designed as a direct test of piloting competence.

2. The Limits of Certification-Based Training Models

FAA Part 107 focuses on regulatory knowledge and operating requirements for small UAS in the National Airspace System. It assesses aeronautical knowledge domains such as airspace, weather, operations, and procedures through an initial aeronautical knowledge test and related administrative requirements.

The Part 107 process does not directly measure manual piloting proficiency, situational awareness, or operational judgment in realistic environments. This limitation becomes consequential when institutions or employers treat certification as synonymous with readiness. When certification is treated as the endpoint, graduates may exit programs with credentialed knowledge but insufficient performance capability. This mismatch between documented qualification and demonstrable ability is the Paper Pilot gap.

Definition: Paper Pilots

Paper Pilots are individuals who hold UAS certifications but lack the manual proficiency, situational awareness, and operational judgment required for real-world UAS operations.

3. Why the Paper Pilot Problem Matters to Institutions

Workforce programs rely on trust. If a credential does not map to reliable performance, employers discount it. Over time, this erodes the workforce value of programs and damages placement outcomes.

Outdoor flight labs introduce institutional exposure: risk of injury, property damage, and noncompliance. Programs that accelerate students into live environments without reliable skill development and evaluation mechanisms can increase incidents or near misses.

CTE and postsecondary programs are often required to document quality and outcomes for funding and accountability. Programs that can demonstrate structured progression and validated competence are easier to defend to administrators, boards, and funding bodies.

4. Competence-Based Training Models: Lessons from Aviation and Technical Trades

Aviation training, industrial robotics, and other high-risk technical domains share a common principle: competence is developed through structured progression and validated through performance assessment.

Competence-based systems introduce skills in controlled environments, build complexity incrementally, and require demonstrated proficiency before advancing. Assessment is embedded throughout training, not only at the end.

High-consequence domains treat safety as a culture reinforced through training design, evaluation, and professional norms. UAS workforce programs benefit from integrating safety practices into instruction and assessment.

5. The Role of Simulation and Applied Evaluation

Simulation enables exposure to challenging scenarios without physical danger. It supports repetition under consistent conditions, which is essential for both skill development and evaluation.

Research in aviation training has long examined the relationship between simulation fidelity and transfer of training. For education leaders, the practical conclusion is that simulation can reduce cost and risk while enabling controlled assessment environments when aligned to real performance requirements.

Outdoor flight performance is difficult to standardize due to environmental variability. Simulation environments can deliver repeatable scenarios, enabling fair assessment and documentation, particularly for decision-making, mission planning, and response to unexpected constraints.

6. Third-Party Validation and External Benchmarking

Independent validation can increase employer trust, provide benchmarking against external standards, and strengthen documentation for boards and funders.

Performance evaluation has been formalized in emergency response and robotics contexts through measurement science and standardized test methods. These efforts illustrate that external benchmarking is feasible and defensible in domains where reliability matters.

Not every institution needs the same level of external validation. Programs serving high-stakes pathways may benefit most. Institutions can adopt a staged approach: build internal competence and documentation first, then add external benchmarking as program maturity and stakeholder needs evolve.

7. Implications for CTE and Postsecondary Institutions

Programs must align with institutional reality: schedules, staffing, facilities, and procurement requirements. Workforce readiness cannot depend on idealized assumptions such as unlimited flight time or specialized facilities.

Documentation is a strategic asset. Records of progression, assessment, and improvement strengthen audit readiness and board confidence.

Outcome claims should be tied to evidence. Certification is an important checkpoint, but institutions benefit from defining specific competencies and collecting performance evidence aligned to those competencies.

8. A Conceptual Framework for Moving From Certification to Competence

Institutions can view UAS readiness as a continuum: regulatory knowledge, manual proficiency, operational judgment, and performance validation. FAA Part 107 primarily addresses regulatory knowledge.

A competence-forward pathway intentionally designs for manual proficiency, operational judgment, and performance validation through structured progression, repeatable evaluation, and documented evidence.

Recommended design principles include: structured progression; repeatable evaluation; evidence documentation; embedded safety culture; and optional external validation where workforce credibility requires it.

Recommended Design Principles

➔ Progression should be structured with prerequisites for advancing into live operations.
➔ Evaluation should be repeatable using standardized scenarios and rubrics.
➔ Evidence should be documented through performance records and summaries.
➔ Safety culture should be embedded as a continuous practice, not a standalone topic.
➔ External validation should be an option for high-stakes pathways requiring deeper credibility.

9. Future Outlook for UAS Workforce Education

As the number of credentialed pilots grows, employers will rely more on performance signals than on baseline certification. Programs that provide evidence of competence will outperform programs that provide only certifications.

Public scrutiny of workforce programs and expectations for accountability are unlikely to decrease. Institutions benefit from defensible, measurable models of readiness.

Measurement and standardized evaluation methods are likely to expand across UAS training contexts, particularly where safety and reliability are paramount.

10. Conclusion

UAS workforce education is entering a maturity phase. Certification remains necessary, but certification alone is insufficient to establish competence. The Paper Pilot gap poses risk to employers, institutions, and students.

Institutions can address this gap by designing competence-based progression models that integrate structured skill development, simulation-supported evaluation, repeatable assessment, and optional third-party benchmarking.

The next generation of UAS programs will be distinguished not by whether students can pass an exam, but by whether institutions can credibly demonstrate what graduates can do when operational demands increase.

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