SYM-AM-26-128

Excerpt from the Proceedings

of the

Twenty-Third Annual Acquisition Research Symposium and Innovation Summit

Volume III

"Accelerating Warfighting Capabilities"

Learning to Fly:
Divergent U.S. Navy, U.S. Army, and Royal Air Force Approaches to Early Aviation

Published: April 30, 2026

The research presented in this report was supported by the Acquisition Research Program, Graduate School of Defense Management at the Naval Postgraduate School.

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Learning to Fly: Divergent U.S. Navy, U.S. Army, and Royal Air Force Approaches to Early Aviation

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Abstract

The early history of military aviation is often described as a struggle between forward-thinking visionaries and traditionalists, or between established institutions and emerging technologies. However, this perspective overlooks a crucial lesson. The fundamental determinant of progress was not organizational belief in aviation, but rather the structure of innovation and learning within those organizations. Examining how the U.S. Army, U.S. Navy, and British military approached aviation during the interwar years offers lasting policy insights. Centrally controlled innovation systems struggle to adapt under uncertainty, while distributed, collaborative learning models exhibit greater resilience. When aviation was managed through a centralized program, innovation faced resistance and stagnation. In contrast, when aviation was treated as a distributed learning challenge, integrated among operators, engineers, trainers, and commanders, the concept persisted and evolved. This distinction is highly relevant to contemporary debates on autonomy, AI, cyber forces, space organizations, and defense-industrial reform.

Introduction

By the end of the First World War, aviation had ceased to be a novelty and had become an inescapable military fact. Aircraft had demonstrated value in reconnaissance, artillery spotting, maritime patrol, and, most provocatively, strategic attack. Yet the war ended before any significant power had fully resolved what aviation meant for military organization, doctrine, or command. The interwar period that followed, therefore, confronted armed services with the same problem: how to absorb a disruptive capability whose implications cut across existing institutional boundaries.

The United States Army, the United States Navy, and the British military all entered this period with aviation experience, but under quite different circumstances—and with vastly different organizational instincts. Those starting conditions shaped how each service would attempt to adopt aviation and ultimately determined whether learning would compound or collapse.

For the U.S. Army, aviation emerged from World War I as both an opportunity and a threat. The Army Air Service had expanded rapidly during the war. Still, it remained subordinate, organizationally, and culturally, to a ground-centric institution whose senior leadership had been shaped by artillery, infantry, and logistics. Aviation promised reach, speed, and strategic relevance—but it also questioned the primacy of land forces and traditional command structures.

In the immediate postwar years, figures such as Brigadier General Billy Mitchell framed aviation not as an adjunct to the Army, but as a fundamentally new way of waging war. Strategic bombing, independent air forces, and decisive effects against an enemy's industrial base all implied a redistribution of authority away from existing branches. Aviation thus arrived in the Army not merely as a new capability, but as a critique of the institution itself.

This framing mattered. From the outset, the adoption of Army aviation was entangled in debates over independence, budgets, and institutional identity. Aviation became centralized around advocates and doctrines rather than embedded across Army routines. As a result, the Army confronted aviation primarily as an organizational and political problem, not yet as a learning system to be integrated (Holley, 1996, pp. 147–156).

The U.S. Navy encountered aviation under different conditions. Naval aviation had proven its worth during the war in patrol, reconnaissance, and anti-submarine roles, but it did not challenge the Navy's core identity as a fleet-centric service. Instead, aviation posed a practical operational question: how could aircraft extend the reach, awareness, and striking power of ships at sea?

In the early 1920s, the Navy responded by creating the Bureau of Aeronautics and placing aviation under stable institutional stewardship. Rather than declaring aviation revolutionary, naval leaders treated it as an evolving tool whose value would be discovered through use. Aircraft carriers, beginning with the USS *Langley*, were not conceived as doctrinal end states but as experimental platforms where aviators, ship handlers, engineers, and commanders could learn together (Lewis, 2024, pp. 55–56).

Crucially, the adoption of aviation in the Navy unfolded through fleet exercises, shipboard routines, and personnel pipelines. Learning was distributed across the organization and tied directly to operational feedback. Aviation did not threaten naval identity; it became part of it. This difference in initial framing—aviation as extension rather than replacement—would prove decisive.

Britain's experience diverged sharply from both American cases. In 1918, even before the implications of wartime aviation had been fully digested, Britain created the Royal Air Force by merging the Royal Flying Corps and the Royal Naval Air Service into a single independent service. This move was driven by wartime exigency, resource constraints, and fears of interservice rivalry—but it fundamentally altered the trajectory of aviation learning.

By centralizing aviation authority at the national level, Britain removed aviation from the operational control of the Army and Navy before either service had consolidated its own aviation practices. Naval aviation became institutionally detached from fleet operations. The Admiralty no longer controlled aircraft design priorities, training pipelines, or doctrinal development, even though it remained responsible for maritime combat (Till, 1979, pp. 30–36).

As a result, aviation adoption in Britain was mediated through a centralized organization whose priorities increasingly emphasized strategic bombing and institutional survival. Feedback from naval operations was filtered through bureaucratic layers rather than incorporated directly into learning loops. Britain entered the interwar period with aviation already organizationally settled—but operationally under-learned (Till, 1979, pp. 187–189).

Three Organizations, Three Strategies

By the early 1920s, all three services possessed aircraft, pilots, and wartime experience. What differed was **the way aviation was governed**. The Army treated aviation as a centrally driven transformational agenda. Britain treated it as a nationally centralized institution. The Navy treated it as a distributed operational learning problem.

These initial conditions shaped everything that followed. They determined where authority resided, how feedback flowed, and whether organizations learned collaboratively or defensively. The sections that follow examine how these different approaches to innovation governance, centralized control versus distributed learning, differ, and how they produced starkly different outcomes when viewed through the lenses of organizational learning and organizational behavior. Organizational learning structure alone did not determine aviation outcomes; it conditioned the extent to which other factors, resources, personalities, and strategic context were translated into durable capability.

The early history of military aviation is often described as a struggle between forward-thinking visionaries and traditionalists, or between established institutions and emerging

technologies. However, this perspective overlooks a crucial lesson. The fundamental determinant of progress was not organizational belief in aviation, but rather **the structure of innovation and learning** within those organizations.

Centralized Innovation Versus Distributed Learning

The **U.S. Army Air Service** adopted a **centralized, top-down innovation model**. Advocates such as Billy Mitchell envisioned airpower as the centerpiece of a reimagined strategy of warfare, emphasizing strategic bombing and a separate air force. This approach relied on concentrated authority and doctrinal mandates, sidelining distributed experimentation. Learning remained confined to a select group of advocates, disconnected from the broader Army's operational, training, and command systems (Johnson, 2000, pp. 162–219). This is not to suggest that the Army Air Service failed to learn altogether; instead, learning remained concentrated within the aviation community and struggled to propagate throughout the broader Army system.

When aviation threatened existing structures, the Army reacted defensively. Instead of integrating feedback from exercises and demonstrations, the institution suppressed it through personnel changes and the marginalization of dissenters, culminating in Mitchell's court-martial. Thus, innovation was centralized, but learning did not permeate the organization. Knowledge was not broadly disseminated, and institutional memory remained weak (Muller, 1996, pp. 144–190).

Britain's **Royal Air Force** provides a clearer example of centralized control of innovation. By consolidating all airpower into a single independent service in 1918, Britain aimed to achieve efficiency and unity. In practice, this move **separated naval aviation from its operational users**. Learning became vertically integrated within the RAF, with horizontal feedback from the Royal Navy filtered, delayed, or ignored. Strategic bombing took precedence, not due to empirical superiority, but because it aligned with the RAF's institutional priorities. The RAF became exceptionally proficient at learning within its own institutional boundaries, while remaining poorly coupled to the operational needs of the maritime domain (Mawdsley, 2019, pp. 17–18).

In both the Army and RAF cases, central control fostered rigidity. Innovation was treated as something to be managed and protected rather than as a collaborative learning process.

The Navy's Distributed Innovation Model

The **U.S. Navy Bureau of Aeronautics** took a distinctly different approach. Rather than concentrating innovation authority, the Navy **distributed learning across platforms, communities, and operational contexts**. Aviation was incorporated into fleet operations rather than isolated as a revolutionary project. Carrier decks, squadrons, shipyards, and training commands all became centers for experimentation.

Importantly, BuAer did not prescribe outcomes in advance. Platforms such as the USS *Langley* served as learning environments, enabling rapid feedback among pilots, deck crews, engineers, and commanders. Aviation expertise became embedded in routines, personnel development, and operational doctrine. Innovation authority was shared rather than monopolized. This distributed approach did not eliminate conflict or inefficiency; carrier aviation developed unevenly and sometimes contentiously, but it preserved learning pathways that allowed correction over time.

This distributed model lessened institutional resistance. Aviation did not threaten naval identity; it expanded it. Consequently, resistance was minimized and learning accumulated over time.

Organizational Learning and Defensive Behavior

Across the three services, aviation knowledge was embedded in fundamentally different ways, shaping how learning persisted or decayed. In the U.S. Army, aviation learning resided primarily in *people*—a small group of advocates—while institutional *processes* for integrating airpower into the broader force remained weak and supporting *tools and routines* underdeveloped, leaving knowledge fragile and vulnerable to resistance and turnover. The Royal Air Force, by contrast, built strong internal *processes* for aviation through centralized doctrine, training, and professional identity. Still, these were poorly coupled with the operational needs of aviation's principal users, especially the Royal Navy, producing deep but narrowly bounded learning. The U.S. Navy struck a different balance: although its formal processes evolved incrementally, aviation knowledge was embedded across *people, platforms, and operational tools* through sustained fleet experimentation, allowing learning to persist, adapt, and accumulate as aviation became an integrated extension of naval operations rather than a centrally managed transformation.

Research by Linda Argote demonstrates that knowledge is preserved only when it is embedded throughout people, processes, and tools, and when organizational memory is protected from erosion due to turnover or structural misalignment (Argote, 2013, pp. 32–35). Centralized innovation systems tend to concentrate knowledge, making it fragile. Distributed systems spread knowledge, making it durable.

Chris Argyris's work explains the defensive behaviors triggered by centralization. The Army and RAF exhibited **Model I behaviors**, deploying defensive routines to protect authority and suppress challenges. Innovation threatened control and was therefore constrained. The Navy leaned more closely toward **Model II**, fostering collaboration, transparency, and shared learning. Innovation became a collective endeavor rather than an imposed change (Argyris, 1999, pp. 179–185).

This approach did not necessarily produce rapid transformation, but it enabled **sustainable adaptation**.

Policy Implications for Today

Contemporary defense challenges increasingly mirror the uncertainties of interwar aviation: rapid technological change and unclear doctrine. Autonomous systems, artificial intelligence (AI), cyber operations, and space architecture present a similar question: **who learns, and how?**

Experience from the interwar period indicates that **centralized control of innovation, even when well-intentioned, can engender institutional resistance**. It favors coherence over learning, authority over feedback, and control over adaptation. Distributed innovation models, in contrast, allow learning to flourish at the operational edge—where knowledge is created and used.

Distributed innovation does not mean abandoning coordination entirely. The Navy's model was not chaotic; it balanced **central coordination and distributed learning**, aligning incentives and authority while maintaining room for experimentation and feedback. That equilibrium is the central lesson—not pure centralization or decentralization.

Conclusion

Military aviation faltered not because technology failed, but because organizational structures suppressed learning. The Army and RAF approached aviation as a centrally managed transformation, triggering defensive resistance. The Navy treated aviation as a distributed learning problem and built an enduring capability. Programs that centralize authority

while decentralizing responsibility—common in contemporary acquisition—risk reproducing the RAF problem: institutional coherence without operational learning.

The lesson for today's defense institutions is straightforward: **innovation should be governed as a collaborative learning system rather than a centrally managed program**. Organizations that ignore this will repeat past mistakes—more quickly, and at greater cost.

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