

The Viability of Non-classified U.S. Military Unmanned Aerial Vehicle (UAV) Technologies in Disaster Public Health Emergency Response, Logistics, Search, and Rescue

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Abstract: Escalating natural and manmade disasters increasingly strain local emergency response systems, exposing gaps in situational awareness, rescue capacity, logistics coordination, and damage assessment. This qualitative narrative inquiry examines how military personnel with advanced education in logistics and humanitarian operations conceptualize the use of non-classified military Unmanned Aerial Vehicle (UAV) technologies in domestic disaster response. Drawing on two phases of data collection, semi-structured narrative interviews and asynchronous reflective journaling, the study analyzes the perspectives of ten U.S. military service members trained in logistics and supply chain management. Findings indicate that military UAVs function as critical capability multipliers by accelerating situational awareness, reducing responder risk, improving logistics visibility, enhancing damage assessment, and supporting interagency coordination across disasters such as floods, hurricanes, earthquakes, wildfires, snowstorms, and mudslides. Participants emphasized that military UAV capabilities exceed those typically available to local fire and police departments in endurance, sensor integration, and operational scalability. The study concludes that non-classified military UAV integration, when appropriately governed and coordinated, significantly enhances the effectiveness, resilience, and life-saving capacity of domestic disaster and emergency response systems.

Keywords: Drone Technology, Public Health, Unmanned Aerial Vehicles (UAVs), Disaster Response, Humanitarian Logistics, Search and Rescue, Emergency Management, Military Support

JEL Codes: H56, H84, L96, Q54, R11

Introduction

Domestic disasters constitute a persistent and escalating threat to human security, public health, and economic stability in the United States. In recent decades, the nation has borne a disproportionate share of global disaster-related economic losses, accounting for nearly half of worldwide costs in a single year, a pattern that underscores the systemic vulnerability of highly developed, densely interconnected societies (Mitsuyoshi, 2014). Beyond economic damage, large-scale disasters increasingly disrupt public health systems by overwhelming medical infrastructure, displacing vulnerable populations, degrading environmental conditions, and exacerbating acute and chronic health risks (Mercer-Bey, 2025).

The growing frequency of national disaster declarations reflects not only environmental volatility but also heightened public health exposure driven by urbanization, infrastructure interdependence, population density, and climate-related stressors. While historical trends cannot precisely forecast future crises, the unpredictability of both natural and human-caused disasters heightens the imperative for adaptive, integrated, and health-centered institutional preparedness rather than reactive responses (Kapucu, 2011). Within this context, the Army's ability to mobilize rapidly, deploy specialized capabilities, and operate at scale remains a

decisive factor in mitigating mortality, protecting population health, reducing human suffering, and limiting secondary economic and health disruptions (Kapucu, 2011).

The strategic relevance of the U.S. Army in domestic disaster response derives not merely from its size but from its unparalleled integration of manpower, logistical depth, medical capacity, and operational readiness. Few national institutions possess the organizational capability to project resources into chaotic environments characterized by damaged healthcare systems, disrupted supply chains, and time-sensitive public health emergencies under conditions of extreme uncertainty and compressed timelines (Kapucu, 2011). As disaster profiles evolve toward higher-impact, lower-predictability events, reassessing the Army's role increasingly requires recalibrations in force structure, investments in specialized capabilities, including medical and public health response, and doctrinal shifts in how civil-military coordination is conceptualized and executed (Kapucu, 2011; Mitsuyoshi, 2014). These adaptations are particularly salient given the substantial transformation of domestic disaster response over the past decade, during which civilian-led emergency management and public health models have matured, even as reliance on military support has intensified during complex, multi-hazard crises (Mitsuyoshi, 2014).

At the institutional level, the Department of Defense (DOD) frames its domestic responsibilities through two interdependent missions: homeland defense and civil support. While homeland defense prioritizes protection against external and asymmetric threats, civil support centers on assisting civilian authorities during large-scale emergencies and disasters, including those with significant public health consequences (Mitsuyoshi, 2014). Civil support encompasses distinct but complementary functions, including Defense Support to Civil Authorities (DSCA), Military Support to Civilian Law Enforcement Agencies (MSCLEA), and Military Assistance for Civil Disturbances (MACD), each governed by specific legal authorities and operational constraints (Mitsuyoshi, 2014). Through DSCA in particular, the military provides critical support to healthcare systems, public health agencies, and emergency medical services when civilian capacities are exceeded, reflecting a deliberate effort to preserve civilian primacy while enabling military intervention to protect lives and population health during a crisis.

Within the Army's tripartite structure, Active, Reserve, and National Guard, the National Guard occupies a uniquely central role in domestic disaster and public health response due to its dual federal-state mandate. Under state authority, Guard units provide immediate, legally flexible response capabilities tailored to local conditions, including medical support, public health assistance, and community stabilization efforts. In their federal role, Guard forces ensure interoperability with national defense and health-related response structures during large-scale emergencies (Mitsuyoshi, 2014). This dual-mission design enables governors to deploy Guard units rapidly to support hospitals, vaccination sites, shelters, and emergency medical operations, while preserving unity of command unless federalization under Title 10 becomes necessary. Active Army and Army Reserve forces typically augment state responses following presidential disaster declarations, operating in support of civilian lead agencies once state and local health systems and emergency services are overwhelmed (Mitsuyoshi, 2014).

In catastrophic scenarios, the Army's contribution spans three interrelated domains: specialized operational skills, command-and-control integration, and broad-based logistical and infrastructural support (Mitsuyoshi, 2014). These functions manifest through a diverse portfolio of capabilities, including emergency medical response, public health logistics, large-scale supply chain management, ground and air transportation, engineering and infrastructure restoration, search and rescue, CBRNE response, situational and damage assessment, communications, and security assistance. Critically, these capabilities support not only immediate lifesaving operations but also disease prevention, continuity of care, and protection of vulnerable populations. In environments where civilian systems have collapsed or are

functionally incapacitated, military capabilities are often substitutive rather than merely additive, enabling continuity of public health and emergency services under extreme conditions (Mitsuyoshi, 2014).

Beyond its tangible operational contributions, the Army serves an underexamined but consequential psychological and public health function in disaster contexts. The visible presence of uniformed military personnel and medical assets conveys institutional competence, state commitment, and national solidarity, reinforcing public confidence and compliance with health and safety directives during moments of profound uncertainty (Mitsuyoshi, 2014). State and federal emergency managers consistently acknowledge that effective disaster response at scale, including the protection of population health, is unattainable without military involvement, as civilian agencies rarely maintain redundant capacities sufficient to absorb catastrophic demand. In this sense, the Army does not merely supplement civilian response mechanisms; it fills structural gaps that would otherwise render recovery, public health stabilization, and long-term resilience infeasible (Mitsuyoshi, 2014).

Taken together, these dynamics position the U.S. Army as a uniquely indispensable actor in domestic disaster and public health response; one whose value lies not only in resources and readiness, but in its capacity to integrate operational effectiveness, medical and public health support, institutional legitimacy, and public reassurance under extreme conditions. As disaster risks intensify and civilian systems face mounting strain, the central challenge facing policymakers is not whether the Army should remain engaged in domestic response, but how to optimize its role to enhance resilience, protect population health, and save lives without eroding civilian leadership or constitutional norms.

Problem Statement

Domestic disasters impose escalating human, economic, public health, and operational burdens on the United States, revealing persistent vulnerabilities in national emergency response systems. In recent years, the United States has incurred the highest disaster-related economic losses globally, accounting for nearly half (49%) of worldwide disaster costs; approximately \$98.5 billion in a single year (Mitsuyoshi, 2014). The accelerating pace of national disaster declarations and the concentration of high-cost events further underscore this trend, with three of the five most expensive global disasters in 2012 occurring in the United States, including Superstorm Sandy, which alone caused an estimated \$50 billion in damage (Mitsuyoshi, 2014). Although historical trends cannot precisely predict future events, the increasing frequency, scale, and unpredictability of both natural and human-caused disasters highlight a growing gap between disaster impact and response capacity (Kapucu, 2011).

The U.S. Army remains one of the few national institutions capable of operating at the scale and speed required during catastrophic disasters due to its manpower, logistical depth, and operational readiness (Kapucu, 2011; Mitsuyoshi, 2014). Through its homeland defense and civil support missions, particularly under Defense Support to Civil Authorities (DSCA), the Department of Defense provides critical assistance to civilian agencies when state and local systems are overwhelmed (Mitsuyoshi, 2014). However, the evolving nature of disaster environments, characterized by rapid onset, degraded infrastructure, complex terrain, and time-sensitive lifesaving demands, has exposed limitations in traditional, labor-intensive response models that rely heavily on manned operations, delayed situational awareness, and fragmented information flows.

Despite the Army's extensive capabilities in logistics, command and control, engineering, transportation, search and rescue, and situational assessment, current disaster response frameworks underutilize emerging technologies that could significantly enhance speed, precision, and safety (Mitsuyoshi, 2014). In particular, unmanned aerial systems (UAS), including drones, offer transformative potential to address critical response challenges by enabling real-time intelligence, rapid damage assessment, precision logistics delivery, and

expanded search-and-rescue coverage in austere or inaccessible environments (Mercer-Bey, 2025). Yet, the absence of standardized implementation models, interoperable governance structures, and integrated operational doctrines has limited the systematic adoption of UAV technologies across military-supported disaster response missions.

This gap is especially evident in high-risk disaster contexts such as wildfires, floods, and large-scale urban emergencies, where outdated legacy systems, fragmented command structures, and delayed situational awareness hinder effective decision-making and frontline deployment (Hodgson et al., 2021; Horton et al., 2024; Jones & Silver, 2019). Without intentional integration of UAV-enabled intelligence, logistics, and rescue operations, emergency response agencies and the military forces supporting them remain constrained by analog paradigms that are increasingly misaligned with the complexity and velocity of contemporary disasters (Mercer-Bey, 2025).

Accordingly, the central problem addressed by this research is the lack of a coherent, standardized, and ethically governed framework for integrating military drones and unmanned aircraft into domestic disaster emergency response, disaster logistics, search and rescue, and disaster relief operations. While the Army is uniquely positioned to fill critical response gaps and provide both operational and psychological stabilization during disasters (Mitsuyoshi, 2014), its effectiveness will increasingly depend on how well emerging unmanned technologies are institutionalized within civil–military disaster response systems. This paper, therefore, seeks to examine how military UAV capabilities can be systematically leveraged to enhance disaster response effectiveness while aligning with legal authorities, ethical standards, and interagency coordination requirements.

Purpose of the Study

The purpose of this qualitative narrative inquiry study is to explore how military personnel with advanced education and professional training in logistics and humanitarian operations make meaning of their experiences with, and perceptions of, the use of unmanned aerial systems (UAS) in domestic disaster response. This study focuses on 10 members of the U.S. military who have completed the Master's in Logistics Management with a concentration in Humanitarian and Disaster Relief at the Florida Institute of Technology and who have also received formal logistics and supply chain training through the U.S. Army. Through the collection and analysis of participant narratives, the study seeks to understand how education, operational experience, and military doctrine shape participants' perspectives on the roles of military drones in disaster emergency response, disaster logistics, search and rescue, and disaster relief. The intent is to illuminate how these professionals conceptualize the opportunities, limitations, and ethical considerations associated with integrating unmanned aircraft into civil–military disaster response environments.

Significance of the Study

This study is significant because domestic disasters continue to increase in frequency, severity, and economic impact, intensifying reliance on military capabilities to support civilian emergency response systems (Kapucu, 2011; Mitsuyoshi, 2014). While unmanned aerial systems offer substantial potential to enhance situational awareness, logistics efficiency, and search-and-rescue effectiveness, their integration into domestic disaster response remains uneven and insufficiently understood from the perspective of military professionals trained in humanitarian logistics. By centering the lived experiences of military personnel with advanced academic and operational preparation, this study addresses a critical gap in the literature concerning how those most directly positioned to employ UAS technologies interpret their utility, constraints, and alignment with disaster response missions.

The findings may contribute to scholarly understanding of civil–military coordination, public health emergency response, technology adoption in crisis environments, and the human factors influencing innovation within military-supported disaster response. Practically, the study may inform military education programs, disaster logistics training, and policy discussions related to Defense Support to Civil Authorities (DSCA) by providing nuanced insights into how unmanned aircraft systems are perceived by those tasked with operationalizing them. Ultimately, amplifying practitioner narratives may support more ethically grounded, operationally realistic, and context-sensitive approaches to integrating military drones into domestic disaster response while preserving civilian leadership and constitutional norms.

Nature of the Study

This research adopts a qualitative narrative inquiry approach to examine how military personnel construct and convey meaning around their experiences with disaster response logistics and the prospective use of unmanned aerial systems. Narrative inquiry is appropriate for this study because it emphasizes participants' stories as primary sources of knowledge, allowing for in-depth exploration of how professional identity, training, and lived experience intersect in complex disaster response contexts. The study will involve 10 purposefully selected participants who meet the criteria of advanced graduate education in humanitarian and disaster logistics and formal U.S. Army logistics and supply chain training.

Data will be collected through in-depth, semi-structured interviews designed to elicit detailed personal and professional narratives related to disaster response experiences, perceptions of UAV capabilities, and reflections on organizational readiness and constraints. Narrative data will be analyzed thematically and structurally to identify recurring patterns, critical incidents, and meaning-making processes across participant accounts. This qualitative design does not seek generalization but rather aims to produce rich, contextually grounded insights that deepen understanding of how military professionals perceive and interpret the integration of unmanned aircraft systems into domestic disaster emergency response, logistics, search and rescue, and disaster relief operations.

One of the primary benefits of qualitative narrative inquiry is its capacity to capture lived experience over time. Unlike other qualitative approaches that fragment data into themes or codes alone, narrative inquiry preserves the temporal, contextual, and relational structure of participants' stories. This allows researchers to understand not just what participants experienced, but how and why those experiences unfolded and were interpreted. Such depth is particularly valuable in domains involving high-stakes decision-making, uncertainty, and ethical judgment, such as disaster response, military operations, healthcare, and emergency management.

Narrative inquiry also enables researchers to surface implicit knowledge, including tacit assumptions, professional judgment, and experiential learning, which are often absent from formal policy, doctrine, or training manuals. By privileging participants' voices, this method reveals how individuals navigate gaps between official procedures and real-world practice, providing insights into adaptation, improvisation, and resilience that are otherwise difficult to document. The value of narrative inquiry lies in its ability to generate contextually rich and practice-relevant knowledge. Rather than abstracting experience into decontextualized variables, narrative research situates knowledge within specific organizational, cultural, and institutional environments. This makes findings especially meaningful for practitioners, policymakers, and educators who must operate within those same contexts.

Narrative inquiry is also uniquely suited to examining change, innovation, and sensemaking. When organizations confront paradigm shifts, such as the adoption of emerging technologies, new operational doctrines, or evolving civil–military roles, individual narratives reveal how such changes are understood, resisted, or embraced at the human level. These

insights are essential for designing interventions, training programs, and leadership strategies that align with how people actually experience organizational transformation. By acknowledging participants as co-constructors of meaning rather than passive data sources, this approach respects professional expertise and lived reality. This is particularly important in research involving military personnel, first responders, or vulnerable populations, where ethical sensitivity and trust are paramount.

The importance of qualitative narrative inquiry lies in its contribution to knowledge generation in contexts where complexity, uncertainty, and human judgment predominate. In fields such as disaster response and humanitarian logistics, outcomes are shaped not only by resources and technologies, but by how individuals interpret risk, authority, responsibility, and ethical obligation under pressure. Narrative inquiry makes these interpretive processes visible and analyzable. Furthermore, narrative inquiry plays a critical role in informing policy and practice beyond compliance-based metrics. While quantitative data may indicate whether a system performs efficiently, narrative research explains why systems succeed or fail in practice. This explanatory power is crucial for refining policies, improving interagency coordination, and ensuring that innovations are implemented in ways that enhance, not undermine, human performance and public trust.

Escalating wildfire emergencies in California reveal systemic weaknesses in contemporary emergency response systems and underscore the growing vulnerability of public safety institutions to climate-driven disasters. Intensifying fire seasons, shaped by climate change, prolonged drought, expanding wildland–urban interfaces, and increasingly volatile weather patterns, have pushed traditional response paradigms beyond their functional limits (Hodgson et al., 2021; Horton et al., 2024; Mercer-Bey, 2025). These conditions demand response architectures capable of generating real-time intelligence, sustaining continuous situational awareness, and coordinating action across fragmented jurisdictions. Yet many emergency organizations remain constrained by legacy technologies, siloed information flows, and labor-intensive processes that are ill-suited to the speed, scale, and uncertainty of modern disaster environments.

Within this operational context, unmanned aerial systems (UAS), including military drones and unmanned aircraft, represent a critical force multiplier for disaster response, logistics, search and rescue, and disaster relief. UAV-enabled capabilities fundamentally reshape how disasters are observed, interpreted, and managed by providing persistent aerial surveillance, high-resolution perimeter mapping, thermal detection of hotspots and survivors, and rapid environmental assessment in terrain inaccessible or unsafe for ground crews (Chen et al., 2022; Mercer-Bey, 2025). When coupled with artificial intelligence and real-time analytics, unmanned aircraft enable a decisive shift from reactive decision-making toward anticipatory, data-driven command and control, delivering actionable intelligence at a tempo unattainable by conventional manned platforms (Hodgson et al., 2021). Evidence from California demonstrates that emergency agencies increasingly recognize this potential and are moving toward embedding UAVs within core operational frameworks rather than relegating them to auxiliary or experimental roles (Ghouzlanas, 2022).

Despite their demonstrated operational value, the integration of UAV technologies into disaster response remains constrained by organizational and governance challenges rather than technological limitations alone (Mercer-Bey, 2025). Effective deployment requires alignment across operational workflows, regulatory compliance, workforce training, public trust, and interagency coordination, conditions that many emergency response systems struggle to achieve simultaneously (Jones & Silver, 2019; Mercer-Bey, 2025). In the absence of system-wide implementation strategies, UAV programs risk fragmentation, inconsistent utilization, and failure during high-consequence events. These risks are particularly acute in disaster logistics and search-and-rescue missions, where delays or coordination breakdowns directly affect survival outcomes.

Technology integration in emergency response, therefore, extends beyond the acquisition of advanced platforms and demands fundamental shifts in organizational culture, leadership practices, process design, and stakeholder engagement (Kotter, 1996; Cameron & Quinn, 2011). In wildfire and disaster response contexts, where decisions must be made under extreme uncertainty and compressed timelines, organizational inertia and delayed adaptation can rapidly cascade into operational failure (Ewert et al., 2020; Saldanha, 2019). Understanding UAV integration as a sociotechnical transformation rather than a discrete technological upgrade is essential for realizing its full life-saving potential (Mercer-Bey, 2025).

Geographic information systems (GIS) significantly amplify the operational value of military UAV-enabled disaster response by converting raw aerial data into shared, actionable intelligence. Integrated GIS platforms, such as ArcGIS, have demonstrated scalability and effectiveness in emergency management by enabling real-time visualization, predictive modeling, and cross-jurisdictional data sharing (Esri, 2022; Perez, 2025). When UAV data streams are fused with GIS environments, emergency managers gain enhanced capabilities for risk assessment, logistics coordination, evacuation planning, and dynamic resource allocation across rapidly evolving disaster landscapes (Zhang et al., 2020; Horton et al., 2024). For military-supported disaster relief operations, this integration extends operational reach, reduces personnel risk, and sustains mission effectiveness in degraded or denied environments (Mercer-Bey, 2025).

At a conceptual level, the shift toward military UAV-enabled disaster response reflects a broader paradigm transformation in public-sector operations (Mercer-Bey, 2025). Technology integration reshapes how organizations generate situational awareness, make decisions, and deliver services under crisis conditions by emphasizing adaptability, integration, and real-time intelligence (Mercer-Bey, 2025). Central to this shift are dynamic capabilities; the capacity to reconfigure resources, integrate emerging technologies, and adapt operational models in response to rapidly changing environments (Teece, 2007). In disaster response, these capabilities are not abstract constructs; they are determinants of operational resilience and life-saving effectiveness (Mercer-Bey, 2025).

Unmanned aerial technologies have already demonstrated transformative value in wildfire management by enabling real-time terrain mapping, hotspot detection, damage assessment, and persistent surveillance at unprecedented levels of speed and accuracy (Chen et al., 2022; Hodgson et al., 2021). Advanced sensor payloads combining thermal, RGB, and multispectral imaging allow UAVs to detect heat signatures obscured by smoke, vegetation, or debris, providing continuous intelligence to command centers and field units alike (Horton et al., 2024; Zhang et al., 2020). Emerging applications further extend UAV utility into active suppression support, including ignition operations for controlled burns and limited payload delivery, reducing reliance on manned aircraft in high-risk conditions (U.S. Department of the Interior, 2020). The development of coordinated drone fleets and swarm-enabled task allocation algorithms further enhances area coverage, route optimization, and operational resilience (Bailon-Ruiz et al., 2022).

The operational value of military UAVs is maximized when embedded within geospatial decision-support ecosystems. GIS-enabled platforms aggregate drone feeds with environmental, demographic, and infrastructural data to generate predictive models of fire spread, air quality assessments, and evacuation scenarios in near real time (Esri Australia, 2022; Horton et al., 2024). Zonation frameworks informed by UAV and satellite data enable agencies to classify fuel loads, assess fire risk, and dynamically prioritize suppression and logistics efforts (Abdollahi & Yebra, 2025; Ghoulane, 2022). Integration with satellite systems further enhances temporal and spatial resolution, enabling continuous refinement of operational forecasts across disaster phases.

Nevertheless, the literature consistently identifies persistent barriers to effective UAV adoption, including regulatory uncertainty, platform interoperability challenges, data overload, workforce training gaps, and ethical concerns related to privacy and surveillance (NFPA, 2021; Ewert et al., 2020; Bednar & Spiekermann, 2023). These challenges highlight the necessity of governance frameworks that balance operational effectiveness with ethical accountability and public trust. Successful UAV integration thus requires alignment between technological capability, organizational readiness, leadership vision, and community values (Mercer-Bey, 2025).

Taken together, the evidence suggests that military drones and unmanned aircraft represent a transformative capability for natural disaster emergency response, disaster logistics, search and rescue, and disaster relief; but only when embedded within coherent digital strategies that integrate leadership, systems thinking, and geospatial intelligence. Bridging the gap between technological promise and operational reality requires moving beyond ad hoc adoption toward structured, theory-informed implementation models capable of sustaining performance in the most extreme disaster environments (Mercer-Bey, 2025).

Methods and Research Design

This study employed a qualitative narrative inquiry design to examine how military personnel with advanced education and training in logistics and humanitarian operations conceptualize the use of non-classified military Unmanned Aerial Vehicle (UAV) technologies in domestic disaster contexts. Narrative inquiry was selected because it enables an in-depth exploration of participants' lived experiences, professional sensemaking, and contextual interpretations of complex operational environments. The design emphasizes how individuals construct meaning through stories, particularly in high-stakes settings such as disaster response, logistics coordination, and search-and-rescue operations.

The study was designed in two distinct, sequential phases to facilitate data triangulation and depth. While Phase One captured immediate, experience-based narratives through live dialogue, Phase Two was intentionally separated to provide participants with an asynchronous environment for deeper, critical reflection. This sequential structure allowed the researchers to use Phase Two as a validation tool, ensuring that the themes surfaced in the interviews were consistent with the participants' more deliberate, written sensemaking.

Participants and Sampling

Participants consisted of 10 military service members who met the following criteria: (a) completion of the Master's in Logistics Management with a concentration in Humanitarian and Disaster Relief at the Florida Institute of Technology, and (b) formal logistics and supply chain training through the U.S. Army. Purposeful sampling was used to ensure participants possessed both academic preparation and operational exposure relevant to disaster response and emerging UAV applications.

Data Collection Procedures for Phase One

Data collection occurred in two phases; this section details Phase One. Phase One consisted of semi-structured narrative interviews conducted virtually. Interviews lasted approximately 60–90 minutes and were audio-recorded and transcribed verbatim. To elicit rich, experience-based narratives, participants were presented with situational examples drawn from realistic, non-classified disaster scenarios. Following each scenario, participants were asked reflective prompts designed to explore how UAV technologies could support search and rescue, natural disaster tracking, logistics support, supply chain coordination, and disaster response. Participants were explicitly informed that discussions were limited to non-classified UAV capabilities, such as aerial surveillance, thermal imaging, mapping, communications relay, and logistics delivery.

Phase One Situational Examples and Feedback Prompts

Situational Example 1: Post-Wildfire Search and Rescue

Participants were presented with a scenario involving rapidly expanding wildfire in a mountainous region where ground access was restricted, communications were degraded, and multiple civilians were unaccounted for following an evacuation failure.

Prompt: *In what ways could non-classified military UAV technologies support search and rescue operations in this scenario? What operational gaps could UAVs help close?*

Situational Example 2: Flooding and Disaster Logistics Coordination

The second scenario described a large-scale flooding event that disrupted road networks and isolated several communities, complicating the delivery of medical supplies, food, and water.

Prompt: *How could UAVs be used to enhance logistics and supply chain coordination during this type of disaster response?*

Situational Example 3: Multi-Jurisdictional Disaster Tracking and Response

The final scenario involved a hurricane impacting multiple counties with fragmented command structures and inconsistent situational awareness across agencies.

Prompt: *How might UAV-enabled data collection and real-time information sharing improve disaster tracking and interagency response coordination?*

Data Analysis

Narrative data were analyzed using thematic analysis, focusing on both the content of participants' stories and the meanings they ascribed to their experiences. Analysis followed an iterative process of (a) initial coding, (b) narrative pattern identification, and (c) thematic synthesis across cases.

Emergent Themes and Definitions

Theme 1: Accelerated situational awareness.

Definition: The use of UAVs to rapidly generate real-time, aerial intelligence that enhances commanders' and responders' understanding of evolving disaster environments. Participants emphasized UAVs as tools that compress decision timelines by providing immediate visual and thermal data, reducing reliance on delayed ground reporting:

In every disaster I've been part of, the biggest delay wasn't manpower; it was understanding what was actually happening. A UAV changes that equation. Instead of waiting hours for teams to report back, you have a live picture of the terrain, the fire movement, or flooded areas. That kind of awareness lets leadership make decisions faster and, honestly, with more confidence, especially when people's lives are on the line.

Theme 2: Risk reduction for personnel.

Definition: The capacity of UAVs to reduce physical danger to responders by replacing or augmenting manned operations in hazardous environments. Participants consistently framed UAVs as protective assets that limit personnel's unnecessary exposure to unstable terrain, smoke, floodwaters, or compromised infrastructure:

We're trained to accept risk, but that doesn't mean we should take it unnecessarily. UAVs allow us to look before we leap. If a drone can scan a collapsed structure or fly into a smoke-filled area before sending Soldiers or first responders in, that's not just efficiency, that's responsibility. It preserves force readiness and protects lives at the same time.

Theme 3: Logistics visibility and precision.

Definition: The role of UAVs in improving logistics and supply chain effectiveness through route assessment, delivery verification, and real-time tracking of supplies. Participants described UAVs

as enablers of logistics transparency, particularly when traditional supply chains were disrupted or degraded. Direct participant quote,

Logistics always becomes the silent bottleneck in disasters. You can have supplies staged, but if you don't know which roads are passable or whether deliveries actually reached [sic.] isolated communities, you're operating blind [sic]. UAVs give logistics planners eyes on the ground, or rather, in the air. They turn assumptions into verified information, which is critical when resources are limited and demand is overwhelming.

Theme 4: Trust, legitimacy, and interagency coordination.

Definition: The contribution of UAV-enabled information sharing to building trust among agencies and improving coordination across fragmented command structures. Participants noted that shared UAV data created a common operational picture, reducing friction and enhancing legitimacy in joint disaster response efforts. Direct participant quote,

What I've seen is that when everyone is looking at the same data, (same) imagery, (same) map, there's less arguing and more acting. UAV feeds create a neutral source of truth. That matters in multi-agency responses because trust breaks down fast when information is inconsistent. Drones don't replace leadership, but they give leaders [sic.] a shared foundation to work from [sic].

Summary

Through narrative inquiry and scenario-based feedback, Phase One revealed that participants view non-classified military UAV technologies as integral enablers of modern disaster response rather than optional enhancements. Their narratives highlight UAVs as tools that accelerate awareness, reduce risk, strengthen logistics, and foster interagency trust; capabilities that are increasingly indispensable in complex, time-sensitive disaster environments.

Phase Two Data Analysis

Phase Two employed an asynchronous qualitative journaling method to deepen and validate insights generated in Phase One. Participants were asked to respond via email to a structured set of open-ended questions provided in a Word document. This approach enabled participants to reflect critically on their professional experiences and perspectives without the time pressure of live interviews, supporting more deliberate sensemaking and narrative depth. Participants were instructed to document real-world observations, lessons learned, and forward-looking insights related to the use of non-classified military Unmanned Aerial Vehicle (UAV) technologies in disaster relief, search and rescue, logistics support, disaster tracking, and emergency response.

Narrative responses were analyzed using thematic narrative analysis, with attention to convergence, divergence, and explanatory depth across participant accounts. Themes were refined through iterative coding and cross-case comparison to identify patterns that extended, clarified, or challenged Phase One findings.

Phase Two Journaling Questions

Participants responded in writing to the following prompts:

1. How can non-classified military UAV technologies enhance disaster relief, search and rescue, logistics support, disaster tracking, and emergency response?
2. What challenges limit the effective integration of UAVs into disaster response operations?
3. What organizational, technological, or policy support is required to enable effective UAV integration?
4. Based on your experience, what best practices should guide the successful integration of UAV technologies in disaster response?

Emergent Themes, Definitions, and Illustrative Quotes

Theme 1: Operational Value Amplification

Definition:

The capacity of UAV technologies to multiply the effectiveness of disaster response operations by improving visibility, speed, and precision across all mission phases.

“What stood out to me most is how UAVs don’t replace people; they make everyone better. In disasters, time and information are the two things you never have enough of. UAVs give you both. Whether it’s identifying survivors, assessing damage, or validating supply routes, they compress the timeline from decision to action. That operational amplification is what makes them indispensable rather than optional.”

Theme 2: Integration Friction

Definition:

Structural, cultural, and regulatory barriers that inhibit seamless UAV adoption within existing disaster response systems.

“The biggest challenge isn’t the technology; it’s everything around it. You can have the best drone in the world, but if policies are unclear, airspace coordination is slow, or people aren’t trained to trust the data, it becomes underutilized. Integration friction shows up where organizations are still thinking in legacy terms while trying to operate in a digital environment.”

Theme 3: Enabling Infrastructure and Governance

Definition:

The organizational, policy, and technical support structures are required to sustain UAV-enabled disaster operations.

“UAV integration only works when it’s backed by governance. That means clear authorities, standardized procedures, interoperable systems, and leadership support. Without that foundation, UAV use becomes ad hoc. With it, drones become part of the operational fabric rather than a special capability brought out occasionally.”

Theme 4: Institutional Learning and Best Practice Formation

Definition:

The development of repeatable, scalable practices that normalize UAV use within disaster response operations.

“What makes UAV integration effective over time is learning. Organizations need to capture what works, institutionalize it, and train on it. The goal shouldn’t be innovation for its own sake, but consistency under pressure. Best practices turn experimentation into doctrine and make UAVs reliable tools rather than experimental assets.”

Practical and Actionable Recommendations

A. Benefits of UAV Use in Disaster Response

1. Integrate UAV reconnaissance as a standard first-response assessment tool.
2. Use UAVs to validate survivor locations prior to ground deployment.
3. Employ UAVs for continuous disaster perimeter tracking.
4. Leverage UAVs for logistics route reconnaissance and validation.
5. Use UAV feeds to support common operational pictures across agencies.
6. Deploy UAVs for infrastructure damage assessments post-disaster.
7. Integrate UAV thermal imaging into nighttime search operations.
8. Utilize UAVs for real-time hazard identification.
9. Incorporate UAV analytics into incident command decision cycles.
10. Use UAVs to support post-event after-action analysis.

B. Challenges to UAV Integration

1. Clarify regulatory authorities for domestic UAV use.
2. Address organizational resistance through leadership engagement.
3. Standardize UAV data formats to reduce interoperability issues.
4. Reduce airspace coordination delays with pre-approved agreements.
5. Mitigate data overload through automated filtering tools.
6. Address privacy concerns with transparent governance policies.
7. Align UAV use with existing incident command structures.
8. Overcome skill gaps through targeted training programs.
9. Ensure redundancy to prevent single-point technology failures.
10. Integrate UAV planning into disaster preparedness exercises.

C. Support Needed for Effective Integration

1. Establish clear UAV governance frameworks at the state and federal levels.
2. Invest in interoperable GIS and command-and-control platforms.
3. Develop standardized UAV operating procedures for disasters.
4. Provide sustained funding for UAV lifecycle management.
5. Expand workforce training in UAV operations and data interpretation.
6. Assign UAV integration officers within emergency management units.
7. Strengthen legal guidance for non-classified military UAV use.
8. Build public communication strategies to reinforce trust.
9. Incorporate UAV integration metrics into readiness assessments.
10. Support joint civil–military UAV training initiatives.

D. Best Practices for Effective UAV Integration

1. Treat UAVs as core capabilities, not auxiliary tools.
2. Embed UAV use into disaster doctrine and planning documents.
3. Train commanders to make decisions using UAV-derived intelligence.
4. Conduct regular UAV-enabled disaster response exercises.
5. Integrate UAV data directly into GIS platforms.
6. Establish interagency UAV coordination protocols.
7. Capture lessons learned through structured after-action reviews.
8. Use modular UAV teams adaptable to disaster scale.
9. Balance autonomy with human oversight in UAV operations.
10. Continuously update UAV practices based on emerging threats.

Summary

Phase Two analysis confirms that participants view non-classified military UAV technologies as essential enablers of modern disaster response, while emphasizing that effectiveness depends on governance, training, interoperability, and institutional learning. The findings extend Phase One by translating narrative insight into actionable guidance, positioning UAV integration as a strategic capability that enhances disaster relief, search and rescue, logistics support, disaster tracking, and emergency response when embedded within coherent organizational systems.

Conclusions

This study demonstrates that the perspectives of military personnel with advanced education in logistics and humanitarian operations offer critical insight into the life-saving value, operational utility, and strategic importance of non-classified military Unmanned Aerial Vehicle (UAV) technologies in domestic disaster and emergency response, including public health response operations. Across both phases of narrative inquiry, participants consistently framed UAVs not as incremental efficiency tools, but as capability multipliers that extend human reach, compress

decision timelines, and enable response actions that many local fire, police, and public health agencies cannot perform with existing resources. In doing so, UAVs directly contribute to saving lives, reducing loss, supporting population health, and improving the overall effectiveness and completeness of disaster response across a wide spectrum of natural and manmade hazards.

A primary benefit identified is the ability of military UAVs to save lives through rapid, wide-area situational awareness, with scale and endurance that exceed most municipal capabilities.

During large wildfires, military-grade UAVs can remain airborne for extended periods to track fire behavior, identify shifting wind patterns, and detect isolated civilians or firefighters using thermal sensors long after smoke and darkness obscure visibility for manned aircraft or ground crews. In flood events, UAVs can survey submerged neighborhoods, locate stranded individuals on rooftops, and assess levee integrity across miles of terrain in hours rather than days. From a public health perspective, these same capabilities enable rapid identification of at-risk populations, support evacuation planning for medically vulnerable groups, and inform emergency medical deployment decisions. Unlike many local agencies that rely on limited drone fleets or visual line-of-sight operations, military UAV platforms are designed for persistent surveillance, broader coverage, and integration with command-and-control systems that support rapid, life-saving, and health-protective decisions.

Participants also emphasized the unique value of military UAVs in search-and-rescue and medical response operations in inaccessible or hazardous environments. In hurricanes, UAVs can be launched immediately after landfall to identify survivors trapped by debris, collapsed structures, or rising waters, even when helicopters are grounded due to weather conditions. Following mudslides, UAVs equipped with thermal and multispectral sensors can detect signs of life beneath debris fields while simultaneously identifying environmental hazards that threaten responder and patient safety. During snowstorms and blizzards, UAVs can locate stranded motorists, assess avalanche risks, and support emergency medical triage by identifying individuals exposed to hypothermia or prolonged isolation. Participants noted that many local fire, police, and public health departments lack the endurance, sensor capability, or integration capacity required to conduct these combined rescue and health surveillance operations at scale, particularly when disasters span multiple jurisdictions simultaneously.

The study further highlights the logistics, supply chain, and medical sustainment advantages of military UAV technologies, which participants described as especially critical during prolonged or widespread disasters. In flood-isolated communities, UAVs can verify viable routes for relief convoys, confirm the delivery of medical supplies, or deliver small but critical payloads such as medications, vaccines, communications equipment, or blood products. After hurricanes, UAVs can rapidly assess damage to ports, rail lines, hospitals, and clinics, enabling faster restoration of healthcare delivery and public health infrastructure. During winter storms, UAV reconnaissance can support fuel distribution, food delivery planning, and emergency power restoration for hospitals, shelters, and long-term care facilities by identifying infrastructure failures across large geographic areas. These capabilities provide a level of logistics visibility, medical supply assurance, and operational precision that most municipal agencies cannot sustain without military support.

Another significant contribution of military UAV technologies lies in damage assessment, public health surveillance, and loss reduction. Participants described how UAV-generated imagery supports rapid post-disaster assessments that guide rescue prioritization, resource allocation, and recovery planning while also informing public health interventions. Following wildfires, UAVs can map burn severity, identify compromised structures, assess air quality impacts, and support environmental health evaluations. After floods or hurricanes, UAVs can document structural damage, utility failures, contamination risks, and population displacement to inform emergency sheltering, disease prevention, and long-term recovery strategies. Snowstorms and mudslides similarly benefit from aerial assessments that reveal

roadway obstructions, structural instability, and secondary hazards that may threaten public safety and health. Participants stressed that early, accurate damage and health risk assessments reduce cascading failures, prevent secondary illness or injury, and mitigate avoidable loss; advantages often beyond the reach of under-resourced local agencies relying on delayed or fragmented ground reports.

Beyond discrete mission functions, participants underscored the role of military UAVs in enhancing coordination across emergency management, public health, and healthcare systems. Shared UAV data feeds create a common operational picture that aligns military, state, local, and public health agencies, reducing duplication of effort and improving unity of action. In multi-county wildfires or region-wide hurricanes, UAV-enabled intelligence supports coordinated evacuations, synchronized rescue and medical operations, and targeted deployment of scarce health and emergency resources. Participants noted that while many fire, police, and public health departments possess limited drone capabilities, they often lack the interoperable systems, analytic tools, and staffing depth needed to integrate UAV data across agencies and jurisdictions at scale.

Collectively, these findings highlight the distinct value and utility of non-classified military UAV technologies as complements to local emergency and public health response capabilities. Military UAVs do not replace fire, police, or public health agencies; rather, they fill critical gaps by providing endurance, sensor sophistication, integration, and scalability that most municipal organizations cannot maintain independently. By extending situational awareness, protecting responders, accelerating rescue, sustaining logistics and medical supply chains, improving public health surveillance, and enabling comprehensive damage assessment, military UAV technologies support more effective, resilient, and life-centered responses to floods, hurricanes, wildfires, snowstorms, mudslides, and other complex emergencies.

In conclusion, this study affirms that non-classified military UAV technologies represent a practical and ethically grounded force multiplier for domestic disaster and public health response. When integrated thoughtfully with civilian leadership and local operations, these systems enhance the nation's ability to respond comprehensively to emergencies, saving lives, protecting population health, reducing loss, and strengthening resilience in the face of increasingly frequent and complex disasters.

References

- Abdollahi, S., & Yebra, M. (2025). Challenges and opportunities in remote sensing-based fuel load estimation for wildfire behavior and management: A comprehensive review. *Remote Sensing of Environment*, 312, 113150. <https://doi.org/10.1016/j.rse.2024.113150>
- Bailon-Ruiz, R., Bit-Monnot, A., & Lacroix, S. (2022). Real-time wildfire monitoring with a fleet of UAVs. *Robotics and Autonomous Systems*, 152, 104071. <https://doi.org/10.1016/j.robot.2022.104071>
- Bednar, K., & Spiekermann, S. (2023). The power of ethics: Uncovering technology risks and positive value potentials in IT innovation planning. *Technology in Society*, 75, 102512. <https://doi.org/10.1016/j.techsoc.2023.102512>
- Cameron, K. S., & Quinn, R. E. (2011). *Diagnosing and changing organizational culture: Based on the competing values framework* (3rd ed.). Jossey-Bass.
- Chen, X., Hopkins, B., Wang, H., O'Neill, L., Afghah, F., Razi, A., Fulé, P., Coen, J., Rowell, E., & Watts, A. (2022). Wildland fire detection and monitoring using a drone-collected RGB/IR image dataset. *IEEE Access*, 10, 121301–121319. <https://doi.org/10.1109/ACCESS.2022.3222805>
- Esri. (2022). *ArcGIS for emergency management: GIS solutions for wildfire response*. <https://www.esri.com/en-us/industries/public-safety/overview>
- Esri Australia. (2022). *Managing bushfires with GIS and AI*. <https://esriaustralia.com.au/gis-in-bushfire-management>
- Ewert, A., Gilbertson, K., Luo, Y. C., & Voight, A. (2020). Simulation training in emergency management: Enhancing knowledge, attitudes, and skills. *Journal of Emergency Management*, 18(2), 97–105. <https://doi.org/10.5055/jem.2020.0452>
- Ghouzlane, S. (2022). Wildfire remote sensing applications. *6th International Students Science Congress*. <https://doi.org/10.52460/issc.2022.027>

- Hodgson, J. C., Baylis, S. M., Mott, R., Herrod, A., & Clarke, R. H. (2021). Drones for conservation and environmental management. *Science*, 373(6552), 304–308. <https://doi.org/10.1126/science.abg9697>
- Horton, D., Johnson, J. T., Baris, I., Jagdhuber, T., Bindlish, R., Park, J., & Al-Khaldi, M. M. (2024). Wildfire threshold detection and progression monitoring using an improved radar vegetation index in California. *Remote Sensing*, 16, 3050. <https://doi.org/10.3390/rs16163050>
- Jones, C., & Silver, H. (2019). Developing digital competence in public safety organizations. *Journal of Public Sector Management*, 32(1), 58–75. <https://doi.org/10.1108/JPSM-08-2018-0025>
- Kapucu, N. (2011). The Role of the Military in Disaster Response in the US. *European Journal of Economic & Political Studies*, 4(2).
- Kotter, J. P. (1996). *Leading change*. Harvard Business School Press.
- Mercer-Bey, Y. (2025). Technology integration in Public Health and Safety: Integrating Drones, GIS, and Satellite Technology in Emergency Wildfire Response. *Health Economics and Management Review*, 6(3), 17–27. <https://doi.org/10.61093/hem.2025.3-02>
- Mitsuyoshi, N. S. (2014). *The Army's role in domestic disaster response: Preparing for the next catastrophe* (Civilian Research Project). Duke University. U.S. Army War College. https://ctpp.sanford.duke.edu/wp-content/uploads/sites/16/2015/09/USAWCDUKECRP19May14_FINALTONICHOLS_.pdf
- National Fire Protection Association (NFPA). (2021). *NFPA 2400: Standard for small unmanned aircraft systems (sUAS) used for public safety operations*. <https://www.nfpa.org>
- Perez, S. (2025). *Oregon OEM real-time GIS transformation using ArcGIS Instant Apps*. [Internal Case Study]. 2024 Oregon Emergency Management GIS Annual Assessment
- Rogers, E. M. (1962). *Diffusion of innovations*. Free Press.
- Saldanha, T. (2019). *Why digital transformations fail: The surprising disciplines of how to take off and stay ahead*. Berrett-Koehler Publishers.
- Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319–1350.
- U.S. Department of the Interior. (2020). *Use of unmanned aircraft systems in fire management*. <https://www.doi.gov/sites/doi.gov/files/uploads/uav-fire-report-2020.pdf>
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, 46(2), 186–204. <https://doi.org/10.1287/mnsc.46.2.186.11926>
- Zhang, Y., Wang, Z., & Chen, X. (2020). Integrating geospatial data into public warning systems: Enhancing risk communication and disaster response. *International Journal of Disaster Risk Reduction*, 50, 101728. <https://doi.org/10.1016/j.ijdrr.2020.101728>