Design, Development, Implementation of UAS Checklists for Multi-Mission Operations

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Unmanned Aerial Systems (UAS) are increasingly deployed across commercial, defense, and research applications, creating a critical need for structured safety practices. Standardized checklists have been shown to reduce human error and enhance operational reliability in manned aviation, and their implementation in UAS operations provides similar benefits. Pre-flight, in-flight, and post-flight procedures outlined in checklists help prevent system failures, miscommunication, and unsafe interactions in shared airspace. Beyond safety, checklist protocols support consistent training, improve procedural adherence, and facilitate compliance with emerging regulatory requirements. As UAS undertakes more complex missions, the adoption of reliable checklist standards becomes essential for maintaining operational safety, ensuring mission success, and enabling the continued integration of UAS into modern aviation systems.

I. Nomenclature

UAS	=	Unmanned Aircraft System
UAV	=	Unmanned Aircraft Vehicle
$sUAS$	=	Small Unmanned Aircraft Systems
$BVLOS$	=	Beyond Visual Line of Sight
DAA	=	Detect and Avoid
SOP	=	Standard Operating Procedure
FAA	=	Federal Aviation Administration
$SORA$	=	X Specific Operations Risk Assessment
$LAANC$	=	Low Altitude Authorization and Notification Capability
NASA-TLX	=	NASA Task Load Index
AERO	=	Aerospace Education and Research Organization

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II. Introduction

Unmanned aerial systems (UAS) pose a large safety hazard due to many factors, including the explosion in UAS usage and the possibility of human error that can lead to crashes and other incidents [1]. This is why it is of utmost importance to introduce proper safety measures to largely decrease the risk of human error in UAS operation. One way to do so is the use of aircraft checklists, which are modeled to eliminate errors [2]. Aircraft checklists are used in many manned aircraft operations, but are not prevalently used for unmanned aircraft. In fact, most research using UAS has failed to mention safety procedures such as the use of checklists or Standard Operating Procedures (SOP). UAS are inherently dangerous due to the possibility of a manned-unmanned aircraft collision [1]. This is why safety measures must go into place, such as properly separating airspace [3].

Flight checklists have been used in manned aircraft for many years. These were also very in-depth and aimed to limit the possibilities for human mistakes to cause any issues. These checklists focus on all parts of flight, but the most important part is the pre-flight checklist. An in-depth pre-flight checklist is important because it ensures that the aircraft is in proper condition to accomplish the planned flight as well as go step by step through take-off, which is one of the most dangerous aspects of flight. Another type of checklist that is used is the emergency checklist. Emergency checklists have been developed for use in flight in the case of extreme issues with certain systems [4]. These types of checklists help the pilot quickly locate and eliminate any possible causes for system issues.

Overall, aircraft checklists are very important to implement properly. They serve to limit the possibilities of human error in each stage of a UAS flight. This helps decrease the possibility of crashes and incidents. Proper UAS safety is only becoming increasingly important as UAS use continues to rise in both the US and around the world. This influenced our research by developing an in-depth UAS checklist for use in the Kennesaw State University Aerospace Education and Research Organization Lab to ensure proper UAS safety at the university, and we hope that other UAS pilots and universities will understand why UAS safety is important. This research also aims to produce a general UAS checklist that can be used for all UAS applications, which can be easily understood and used by any properly trained UAS pilot.

III. Literature Review

In this section, a review of the benefits of checklists, the development procedure, and their uses as documented in the literature is summarized.

Weldon found a severe lack of any of the important aspects of safety found in most UAS research. This includes the use of SOPs, effective crew-resource management, and organizational safety measures. He also connected this to an increased accident rate in UAS compared to manned aircraft [1].

Frederick Stoliker takes a deep dive into the beginning tests of an aircraft, and one important aspect of this is the development of a flight checklist during the testing and development phase of a new aircraft [2].

Maria Kovacova introduces current issues with the use of UAS and ways to ensure UAS is not used unsafely by partitioning airspace for safe UAS usage [3].

Barbara Burian presents a detailed, human-factors–based model for designing emergency and abnormal checklists in aviation, focusing on how checklist format, wording, navigation, and layout interact with constraints like stress, time pressure, and high workload to influence crew use [4].

Johnson examines the use and development of checklists for non-normal situations in conjunction with specialized training, including both emergency and non-emergency aircraft issues, finding that such checklists effectively prepare pilots and crew for these scenarios. Key checklist principles include supporting effective operations, maintaining clarity and relevance, ensuring consistency with other checklists, promoting retention and usability through memory-based and step-by-step actions, facilitating communication between pilots and the air boss, and preserving efficiency without compromising safety [5].

Researcher Hendarko used a case study of the Lapan Light Surveillance Aircraft and utilized a fault tree analysis to investigate critical components to inform UAV pre-flight checklists. As part of that study, the authors created a checklist with the following seven major sections: engine (general), fuel system, lubrication system, ignition and electrical system, propeller, drive connection, and flight control system [6].

Key Dismukes analyzed why cockpit checklists and monitoring procedures sometimes fail, despite being critical defenses in aviation safety. The report identifies factors such as human error, workload, and attentional lapses, offering strategies to strengthen checklist design and crew coordination [7].

Scott Xiang Fang investigates the operations of BVLOS UAS, inclusive of hardware criteria, emergency features, and safety strategies. Their BVLOS SOP describes the processes related to payload implementation, pre-flight checks, geo-fence and flight plan implementation, FPV monitoring, and manually vs. automatically controlling flights; all of which can be themes for a process used to formulate individualized BVLOS checklists [8].

The author of this checklist provides standardized procedures for safe UAS flight operations at the University of Wyoming, covering pre-flight, in-flight, and post-flight tasks. It ensures consistency, regulatory compliance, and risk mitigation for student and research UAS operations [9].

The author of the Colorado School of Mines checklist guides operators through critical pre-flight and post-flight steps to ensure UAS safety and operational readiness. It emphasizes task verification, equipment inspection, and documentation to reduce errors and support consistent training practices [10].

The FAA preflight checklist outlines mandatory steps for UAS operators to verify compliance with federal regulations and ensure safe operation. It covers equipment inspection, flight planning, and environmental assessment to minimize risks and promote standardized safety practices [11].

Teresa Cabral examines key aspects of UAS safety, including airworthiness specifications and various risk assessment tools, finding that the Specific Operations Risk Assessment (SORA) provides the most comprehensive approach, though standardization is still needed. The SORA framework highlights factors critical for checklist development, such as ground risk class, which evaluates the potential danger on the ground, and air risk class, which considers flight altitude. Overall, the study emphasizes the importance of assessing flight operations to ensure safe and effective UAS planning [12].

The FAA's Preflight Checklist for UAS provides a structured system for safe, reliable, and compliant operations of unmanned aircraft systems. The document outlines critical steps, including the manual inspection of the airframe, propellers, and battery, checking/reviewing GPS and communication systems, and calibration of sensors. The document also requires external phenomena to be acknowledged, including weather and airspace considerations, ensuring that the pilot is operating within a safe and legal environment. The checklist includes procedures promoting a disciplined methodology toward flight readiness, including the Go/No-Go Decision and final safety checks. In summary, the FAA Checklist serves as a guide and best-practice standard for all UAS operators, fostering reduced risk and responsible flight operations [13].

The FAA's Part 107 establishes the rules for the commercial operation of small unmanned aircraft systems (sUAS) in the United States, outlining requirements for pilot certification, aircraft registration, operational limitations, and safety procedures. It provides a standardized regulatory framework to ensure safe integration of drones into the national airspace while supporting innovation and research applications [14].

The NASA Task Load Index (NASA-TLX) is a widely used subjective assessment tool developed by Sandra G. Hart and Lowell E. Staveland to measure perceived workload across six dimensions: mental, physical, and temporal demand, performance, effort, and frustration. It provides a standardized method for evaluating operator workload in aviation, spaceflight, and other high-performance systems, helping researchers quantify and compare task difficulty and human performance [13].

IV. Methodology

This research employed a qualitative methodology to examine the current practices, best practices, and human factors considerations of Unmanned Aircraft Systems (UAS) operational checklists across both educational and professional contexts. The study utilized a mixed approach, combining a systematic review of peer-reviewed literature with a detailed content analysis of publicly available UAS checklists. The qualitative paradigm was selected due to the exploratory nature of this research, as the goal was to identify patterns, gaps, and areas for improvement in checklist design rather than to quantify outcomes statistically.

The research design was structured to provide technical rigor while ensuring relevance to operational applications. Three primary data sources were included: scholarly journal articles addressing checklist design [4], human factors, and UAS operational safety [5], institutional checklists from universities and research organizations, and regulatory checklists and guidance published by the Federal Aviation Administration (FAA) and other professional bodies. Each source contributed distinct insights into checklist construction, operational priorities, and risk mitigation strategies.

Peer-reviewed literature was selected using criteria designed to maximize relevance, credibility, and timeliness. First, articles were required to focus explicitly on UAS or manned aviation checklists, including emergency, abnormal, or pre-flight operational checklists. Studies addressing broader aviation safety or human factors principles were included if they provided direct implications for checklist design or procedural adherence.

Second, credibility was assessed based on publication in recognized journals, conferences, or institutional reports with peer-review processes [4] [7]. Third, timeliness was prioritized, favoring publications within the past 15 years for UAS-specific content, while seminal works in manned aviation checklist design were also included for their foundational principles. Classic aviation human factors studies, such as Burian and Johnston, provided insights into checklist usability, cognitive load management, and task prioritization, which remain directly relevant to UAS operational design.

Finally, the literature selection process ensured comprehensive coverage of multiple checklist design paradigms, including manual, electronic, and automated formats. Key studies addressing pre-flight inspection procedures, emergency response, and beyond visual line-of-sight (BVLOS) operations were emphasized to provide a full spectrum of operational contexts [8].

A. Examination of Existing UAS Checklists

The second component of the methodology involved collecting publicly available UAS checklists from educational institutions, professional organizations, and regulatory bodies. Sources included the University of Wyoming Flight Operations Procedures Checklist [9], the Colorado School of Mines UAS checklist [10], FAA pre-flight and operational guidance [11], and other publicly disseminated resources such as regulatory.gov publications. Only documents available without proprietary restrictions or special access were utilized, ensuring ethical compliance and reproducibility. Checklists were selected based on operational scope, including both instructional and professional applications. Institutional checklists provided insights into procedural clarity, usability for operators with varying experience levels, and integration of training protocols. FAA checklists and guidance documents contributed to regulatory alignment, standardized procedural steps, and risk-based task categorization. The inclusion of multiple sources allowed for a comparative analysis that identified recurring structural patterns and gaps across operational contexts.

Once sources were collected, the research proceeded with systematic extraction of relevant data. A coding schema was developed to identify common checklist elements, structural characteristics, and procedural strategies. Effective UAS operations happen as a result of comprehensive pre-flight and post-flight inspections of the condition of the airframe, propulsion system, avionics, sensors, battery and power systems, and payloads. Consistent performance of operational tasks, pre-flight briefings, geofencing, checking communication links, mission planning, and software coordination is important for safe, efficient flight. Awareness of the environment and situational awareness, which may include weather, airspace, and/or potential ground hazards, is essential for accident prevention and lawful operation. Safety and emergency protocols, including loss of signal, fail-safe, collision avoidance, and a list of emergency contacts, also mitigate risk. Documenting these aspects of operations in a systematic way may allow consistent performance, reduce human factors, and improve the overall safety of the mission.

Each checklist was coded by marking the presence or absence of these elements, noting the level of detail, clarity of instructions, and usability considerations. Additional codes were added iteratively to capture unique elements, such as BVLOS-specific steps, sensor calibration procedures, or automation features, ensuring that the coding framework remained adaptive to emerging patterns.

The coded data was analyzed using thematic content analysis, allowing the identification of recurring patterns, gaps, and best practices. Themes were categorized at two levels: procedural structure and technical content. Procedural structure addressed sequence logic, hierarchical organization, phased operation (pre-flight, in-flight, post-flight), and integration of checks for risk mitigation. Technical content evaluated the inclusion of critical components such as propulsion, battery management, environmental considerations, and regulatory compliance.

Thematic analysis was iterative, with cross-referencing between literature findings and checklist content to ensure technical accuracy. For example, principles of emergency checklist design [4] from Burian and Johnston were mapped onto UAS checklists to evaluate adherence to human factors guidelines. Electronic and automated checklist research was used to assess the integration of cognitive load reduction strategies and real-time feedback mechanisms. Risk assessment frameworks such as Specific Operations Risk Assessment (SORA) informed the categorization of checklist tasks by operational criticality [12].

Comparative evaluation involved contrasting checklist practices across educational, professional, and regulatory contexts. Structural differences were assessed, such as the length, complexity, and modularity of checklists. Technical differences included the scope of pre-flight inspections, inclusion of BVLOS-specific procedures, and emergency response integration.

Each checklist was scored qualitatively against criteria derived from the literature: clarity, completeness, consistency, usability, and alignment with regulatory guidance. This approach highlighted both exemplary practices and areas requiring improvement. For instance, institutional checklists often emphasized brevity and ease-of-use for instructional purposes, whereas FAA checklists provided exhaustive detail for regulatory compliance. This comparative lens provided insights into balancing operational efficiency with safety, particularly in multi-operator or high-risk scenarios.

To ensure methodological rigor, multiple strategies were employed. First, triangulation was applied by comparing findings across literature, institutional checklists, and regulatory documents. This approach enhanced reliability and reduced bias associated with single-source reliance. Second, coding and thematic extraction were reviewed iteratively to confirm consistency and accuracy, ensuring that all procedural elements were captured faithfully. Third, all sources were cross-verified for currency, credibility, and compliance with intellectual property regulations.

While the study employed qualitative methods, attention was given to technical specificity. Checklist elements were mapped directly to operational functions, allowing actionable insights for real-world applications. Human factors considerations were grounded in empirical literature, ensuring that recommendations are evidence-based and practically relevant.

B. Best Practices for Generating Checklists

According to the FAA's Preflight Checklist for UAS [13], the following list includes best practices as well as foundational requirements for any UAS checklist. Before each flight, the most important requirement is to conduct a thorough and complete visual inspection of the airframe. This visual inspection includes checking for evidence of cracks, loose or damaged parts on the airframe, and particularly on the propellers and motors, which in the air could lead to the aircraft having issues. The battery should always be fully charged and inspected for signs of swelling or damage that can compromise the battery's ability to deliver reliable power in flight. Other significant preflight items include verifying that the GPS and compass antennas are attached and undamaged and confirming the system can acquire and receive a good signal to ensure the aircraft can navigate safely and effectively.

The FAA checklist points out the need to examine the remote controller before flying. The controller battery should be charged; all buttons and joysticks should operate freely, and there should be a firm and stable connection between the drone and the controller. Operators will also be expected to check for and install any software and firmware updates and ensure the system's sensors—primarily the IMU and compass—are calibrated appropriately. Updates and calibrations help the drone fly more accurately and respond appropriately to pilot inputs.

Another best practice that appears in every UAS checklist is the weather and airspace checks. The pilot must ensure that there are acceptable weather conditions, such as wind speed and temperature for flying, and that the drone is not flying into prohibited or controlled airspace. Finally, prior to takeoff, a control and safety check is essential. This control check consists of checking each movement, such as yaw, pitch, and roll, and performing a short idle propeller spin to hear for any unusual sounds, with another aspect of safety to ensure the area surrounding the drone is clear of people and obstacles. Then the pilot will make the Go/No-Go decision. The pilot will look at everything that was checked and see if it is safe to conduct the flight.

All these steps, from visual inspections to safety checks, are established best practices in the industry because they protect the drone and its environment. Adhering to these procedures leads to accurate operation, avoids accidents, and ensures compliance with the Federal Aviation Administration. In short, these checklist points are not simply recommendations; they are the fundamental habits that every responsible UAS operator should demonstrate before every flight.

C. Kennesaw Checklists

In this study, the Kennesaw State University AERO-lab developed a series of customized checklists tailored to the operation of various Unmanned Aircraft Systems (UAS). The methodology involved first categorizing the UAS by type and mission profile, including fixed-wing and multirotor. For each category, the team identified critical pre-flight, in-flight, and post-flight procedures based on manufacturer recommendations, FAA guidelines, and prior operational experience. These procedures were then distilled into clear, step-by-step checklist items to ensure safety, consistency, and operational efficiency. The checklists were tested through iterative flight trials, during which the AERO-lab team recorded deviations, errors, and operational challenges. Feedback from these trials was used to refine the checklists, ensuring that they addressed both standard and non-standard flight scenarios while remaining practical for field use.

Fig. 1 shows an earlier iteration of the checklist. The final versions of the Kennesaw State checklist can be seen in Fig. 2. This shows the final iteration of the checklist, which has been streamlined compared to much older versions. The earlier iteration of the checklist is much smaller compared to the final version, but due to multiple tests and continued improvements, we found it was pivotal to expand the scope of the checklist so all hazards are accounted for. Also, a general pilot checklist was developed for use outside of the Kennesaw State aerospace research lab. This checklist, seen in Figure 5, includes all of the same sections and steps as our final Kennesaw State University checklist, but uses more general wording so it can be utilized by any UAS pilot.

Kennesaw State Aerospace Lab

UAS (Drone) Checklist

Prior to Leaving the Lab

1. Charge Batteries ☐
2. Get UAS/Fixed Wings ☐
3. Get Chairs ☐
4. Get Tents ☐
5. Get Field Box ☐

Pre Flight Pt. 1

1. Check Weather W/ Fly Q ☐
2. Declaire Flight Plan ☐
3. Take Off Camera Protection ☐
4. Set Drone Facing Away From Pilot ☐
5. Lift Props Up And Out ☐
6. Ensure Everyone Is Clear ☐

Pre Flight Pt. 2

1. Turn On Radio/Controller ☐
2. Plug In Batteries ☐
3. Ensure Everyone Is Clear ☐
4. Announce Takeoff ☐
5. Slowly Lift Off ☐

In Flight Checklist

1. Stay In Flight Zone ☐
2. Stay above tree level + 10ft (~35ft) ☐
3. Keep UAS In Sight ☐
4. Stay Away From Any Objects ☐

Post Flight Pt. 1

1. Ensure Area Is Clear Before Landing ☐
2. Announce Before Landing ☐

Post Flight Pt. 2

1. Remove Batteries After Landing ☐
2. Turn Off Radio/Conteroller ☐
3. Return All Equipment To The UAS. ☐
4. Secure UAS In Safe Location. ☐

Back in the Lab

1. Discharge Batteries ☐
2. Don't Discharge Over Night ☐
3. Debrife On Flight ☐
4. Restore All UAS/Fixed Wings To Original State ☐

Please Note:

1. Log Flight
   - A. Location
   - B. Time
   - C. Battery
   - D. Notes
2. Keep Track Of Items
3. Be Aware

Fig. 1 First Iteration of Kennesaw UAS Checklist

Standard Pilot Checklist

Made by Kennesaw State AERO Lab

General UAS Operations

Prior to Drone Operation

1. Plan Flight Opperations/Path
2. Charge Flight Batteries
3. Charge Radios/Controllers
4. Secure UAS For Transportation
5. Pack Ground Support Equiptment
6. Bring Tool Box and Field Box

Pre-Flight

7. Check Weather
   A.) Visibility:
   B.) Wind:
   C.) Cloud Base:
   D.) Temp:
   E.) Dew Point Temp:
   F.) Altimeter Settings:
8. File Flight Plan
9. Take Off Camera Protection
10. Set Drone Facing Away From Pilot
11. Clear Props
12. Remove Prop Guards
13. Inspect UAS and Props for Damage
14. Secure Loose Cables
15. Secure Antennas
16. Ensure Area Is Clear
17. Record Flight Start Time: ________
18. Record Pre-Flight Battery Voltage:

Take Off

19. Turn On Radio/Controller
20. Plug In Batteries on UAS
21. Ensure Flight Line is Clear
22. Announce Takeoff
23. Slowly Lift Off

In Flight Checklist

24. Execute Flight Plan/Operations
25. Stay above tree line + 10ft (~35ft)
26. Keep UAS In Sight
27. Stay Away From Any Objects (Inlcuding Other UAS)

Pre-Landing

28. Ensure Area Is Clear Before Landing
29. Announce Before Landing
30. Land Slowly

Post-Flight

31. Disconnect Batteries After Landing
32. Turn Off Radio/Controller
33. Install Prop Guards/Camera Cover
34. Secure UAS In Safe Location
35. Record Post-Flight Battery Voltage:

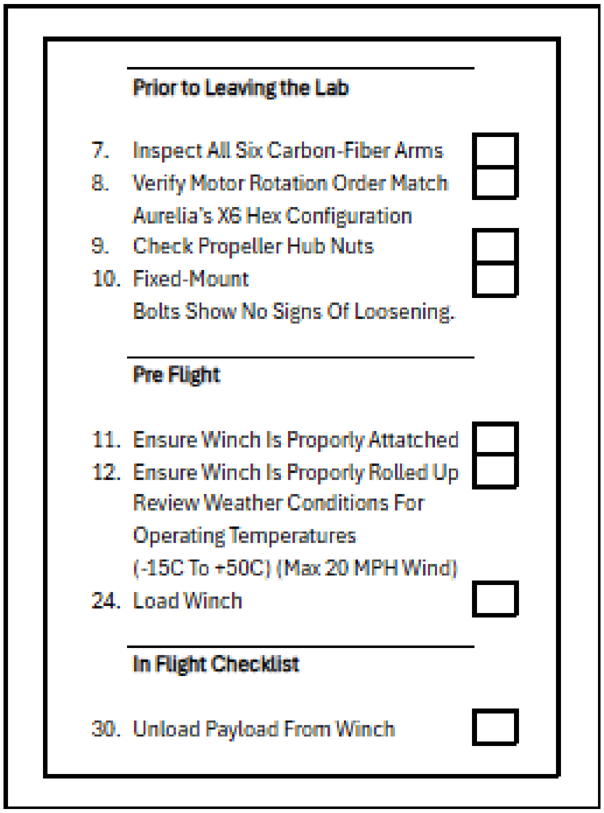
Additional Information:

36. Log Flight
    A.) Location: ________________
    B.) Time:
        a.) Before Flight (17): _______
        b.) After Flight: ____________
    C.) Battery Voltage:
        a.) Pre-Flight (18): _______
        b.) Post-Flight(35): ________
37. Pack and Stow Away all Ground Equipment
38. Storage Charge Batteries
39. Don't Discharge Over Night
40. Debrief/Notes On Flight
41. Restore All UAS To Original State and Location

Additional Notes:

Fig. 2 Latest General Kennesaw UAS Checklist

To enhance safety and operational efficiency, the Kennesaw State University AERO-lab implemented specialized checklists designed for the unique demands of various Unmanned Aircraft Systems (UAS). Unlike generic checklists, these tools focus on addressing both standard and non-standard flight scenarios, incorporating platform-specific requirements and potential emergency situations. By providing a structured framework for pre-flight, in-flight, and post-flight procedures, the specialized checklists ensure that operators consistently follow best practices, reduce the likelihood of errors, and maintain compliance with regulatory and manufacturer guidelines. * Some specialized UAS checklists include Payload Drone (X8 MAX) (UAS 1), Flag Spoil Drone (X6 Pro) (UAS 2), Police Drone (X8 Standard) (UAS 4), Flags and Ribbons Drone (X6 MAX) (UAS 5), and Winch Drone (X6) (UAS 6). All of these UAS have very different tasks; therefore, they need specialized checklists for maximum efficiency and safety.



Prior to Leaving the Lab

7. Inspect All Six Carbon-Fiber Arms
8. Verify Motor Rotation Order Match Aurelia's X6 Hex Configuration
9. Check Propeller Hub Nuts
10. Fixed-Mount Bolts Show No Signs Of Loosening.

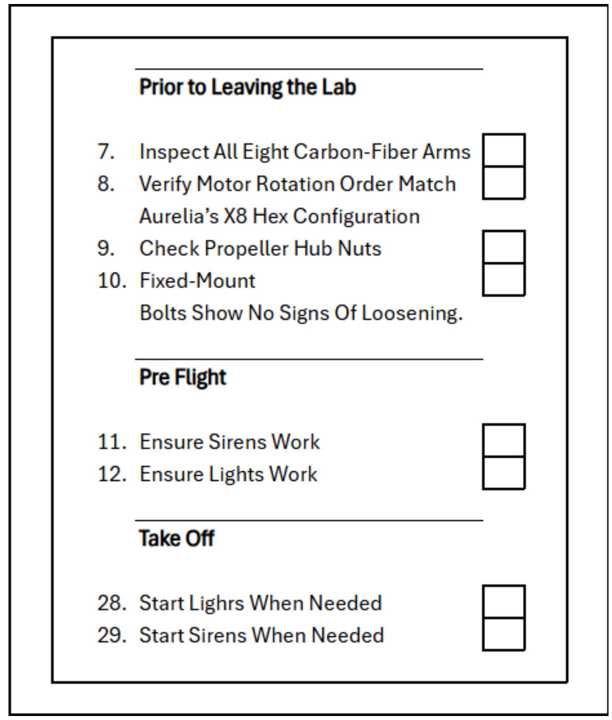
Pre Flight

11. Ensure Winch Is Properly Attatched
12. Ensure Winch Is Properly Rolled Up Review Weather Conditions For Operating Temperatures (-15C To +50C) (Max 20 MPH Wind)
24. Load Winch

In Flight Checklist

30. Unload Payload From Winch

Fig. 3 Winch UAS



Prior to Leaving the Lab

7. Inspect All Eight Carbon-Fiber Arms
8. Verify Motor Rotation Order Match Aurelia's X8 Hex Configuration
9. Check Propeller Hub Nuts
10. Fixed-Mount Bolts Show No Signs Of Loosening.

Pre Flight

11. Ensure Sirens Work
12. Ensure Lights Work

Take Off

28. Start Lighrs When Needed
29. Start Sirens When Needed

Fig. 4 Police UAS

The methodology incorporated rigorous qualitative exploration and technical components to conduct a comprehensive review of UAS operational checklists while maintaining strict ethical considerations. All checklists used in the study were publicly available, and all existing studies were explicitly cited, and data were anonymized where necessary to avoid revealing sensitive procedures. Documented resources used in coding, the coding scheme, and the process of analysis provided transparency for reproducible research and independent validation of findings. The studies were constructed from institutional checklists, regulatory guidance documents, and the literature to extract critical elements of procedures and structural patterns, and considered human factors, and comparison of practices through coding and thematic analysis to inform best practices and identify gaps across operational environments. As written, the methodology was intended to be technically relevant, and there are limitations: only publicly available checklists were analyzed, emerging technologies such as completely autonomous flight and advanced detect-and-avoid systems are not well represented, and the qualitative approach provides an informative description but does not conduct statistical generalization. Despite these limitations, this approach demonstrates a technically defensible way of developing coverage of optimized UAS checklists to improve UAS safety, efficiency, and regulatory compliance in educational and organizational environments.

Standard Pilot Checklist

Made by Kennesaw State AERO Lab

General UAS Operations

Prior to Drone Operation

1. Plan Flight Opperations/Path ☐
2. Charge Flight Batteries ☐
3. Charge Radios/Controllers ☐
4. Secure UAS For Transportation ☐
5. Pack Ground Support Equiptment ☐
6. Bring Tool Box and Field Box ☐

Pre-Flight

7. Check Weather ☐
   A.) Visibility: ☐
   B.) Wind: ☐
   C.) Cloud Base: ☐
   D.) Temp: ☐
   E.) Dew Point Temp: ☐
   F.) Altimeter Settings: ☐
8. File Flight Plan ☐
9. Take Off Camera Protection ☐
10. Set Drone Facing Away From Pilot ☐
11. Clear Props ☐
12. Remove Prop Guards ☐
13. Inspect UAS and Props for Damage ☐
14. Secure Loose Cables ☐
15. Secure Antennas ☐
16. Ensure Area Is Clear ☐
17. Record Flight Start Time: ________ ☐
18. Record Pre-Flight Battery Voltage: ☐

Take Off

19. Turn On Radio/Controller ☐
20. Plug In Batteries on UAS ☐
21. Ensure Flight Line is Clear ☐
22. Announce Takeoff ☐
23. Slowly Lift Off ☐

In Flight Checklist

24. Execute Flight Plan/Operations ☐
25. Stay above tree line + 10ft (~35ft) ☐
26. Keep UAS In Sight ☐
27. Stay Away From Any Objects (Inlcuding Other UAS) ☐

Pre-Landing

28. Ensure Area Is Clear Before Landing ☐
29. Announce Before Landing ☐
30. Land Slowly ☐

Post-Flight

31. Disconnect Batteries After Landing ☐
32. Turn Off Radio/Controller ☐
33. Install Prop Guards/Camera Cover ☐
34. Secure UAS In Safe Location ☐
35. Record Post-Flight Battery Voltage: ☐

Additional Information:

36. Log Flight ☐
    A.) Location: ________________
    B.) Time:
       a.) Before Flight (17): _______
       b.) After Flight: ____________
    C.) Battery Voltage:
       a.) Pre-Flight (18): _______
       b.) Post-Flight(35): ________
37. Pack and Stow Away all Ground Equiptment ☐
38. Storage Charge Batteries ☐
39. Don't Discharge Over Night ☐
40. Debrief/Notes On Flight ☐
41. Restore All UAS To Original State and Location ☐

Additional Notes:

Fig. 5 General UAS Pilot Checklist

V. Results and Discussion

The implementation of specialized UAS checklists within the Kennesaw State AERO-lab demonstrated measurable improvements in operational consistency, safety, and mission readiness across multiple aircraft platforms. Through iterative testing with both rotary and fixed-wing UAS, the lab's newly developed checklists significantly reduced procedural errors compared to standard manufacturer or FAA-based generic checklists. Observations during routine flight operations showed that pre-flight errors, such as leaving necessary parts in the lab or incomplete sensor calibration, were reduced after consistent use of the customized checklists.

In addition to quantitative performance improvements, user feedback from student operators and research staff indicated higher confidence levels and reduced task saturation, particularly during pre-flight and emergency response procedures. This finding supports previous research highlighting the relationship between checklist usability and human factors performance in aviation operations. The specialized UAS checklists were designed to be concise, modular, and platform-specific, which allowed for easier integration into diverse research projects while maintaining compliance with FAA Part 107 [14] standards and Kennesaw State University AERO-lab internal safety protocols.

A qualitative review of post-flight debriefs revealed that teams using the specialized checklists showed greater procedural compliance under time constraints compared to those relying on non-standardized or memory-based procedures. Furthermore, the inclusion of visual verification items improved situational awareness and reduced the likelihood of missed critical steps. The development process itself, combining human factors principles, FAA guidance, and field testing, proved essential in producing a tool that was both operationally effective and adaptable.

Overall, the results demonstrate that a tailored checklist system can bridge the gap between manned aviation checklist theory and UAS operations. While traditional checklist philosophy emphasizes procedural compliance, the AERO-lab's approach also prioritizes adaptability, training efficiency, and human-centered design. The outcomes indicate that specialized checklists not only enhance operational safety but also serve as an effective educational tool for developing professional-level flight discipline among student researchers. Future work will involve quantitative workload analysis using NASA-TLX scoring [15] and time-motion studies to further validate the observed improvements in efficiency and error reduction.

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