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**Public Perception of Unmanned Aerial Systems (UAS): A Survey of Public Knowledge Regarding Roles, Capabilities, and Safety While Operating Within the National Airspace System (NAS)**

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# PUBLIC PERCEPTION OF UNMANNED AERIAL SYSTEMS (UAS): A SURVEY OF PUBLIC KNOWLEDGE REGARDING ROLES, CAPABILITIES, AND SAFETY WHILE OPERATING WITHIN THE NATIONAL AIRSPACE SYSTEM (NAS)

Dennis Vincenzi,<sup>\*</sup> David Ison,<sup>†</sup> and Dahai Liu<sup>‡</sup>

A variety of challenges to the successful assimilation of Unmanned Aircraft Systems (UASs) into the National Airspace System (NAS) exists. Aside from technical and legislative challenges, another setback has recently surfaced when the FAA suspended its selection process for UAS test sites due to privacy concerns. This new obstacle has the potential to further delay UAS integration. Very little literature or coverage of UAS domestic operations and accidents have been published and made available to the public at large. As a result, the public has very little information upon which to form any realistic or reasonable opinions concerning the integration of UASs into the NAS and the threat to public safety that may ensue as a result of this planned action by the FAA and private industry. There are many safety related issues that the public are not aware of that may adversely affect decisions made by the FAA to move forward with full scale integration of UASs into the NAS. If the UAS community is to be successful in its efforts to initiate widespread use of UASs over populated areas in the NAS, they would do well to consider educating the public on the pros and cons of using UASs in the NAS, and should keep the public informed of progress in areas that directly affect the public such as safety. This study will consist of a review of the current literature related to public opinion polling and public perception about domestic UAS operations. Results of a pilot public opinion poll ( $n = 223$ ) developed during this research is presented in a reflective, narrative format. An overwhelming majority of polled individuals (95%) were familiar with UASs. Slightly less than half of respondents agreed they would be comfortable with UASs in domestic airspace with firefighting and weather monitoring being the most acceptable uses of the systems. The highest level of concern about UASs (46%) was privacy versus safety (38%). Results indicate the public is cognizant of UAS operations but are not ready to accept widespread use of the technologies. Also, privacy does seem to be a primary concern.

## INTRODUCTION

The use of Unmanned Aircraft Systems (UASs), also commonly referred to as “drones,” commonly appears in the news headlines. Usually the reports chronicle the use

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of such systems to counter terrorist activities in a foreign country often involving the killing of personnel on the ground.<sup>1,2</sup> According to one congressional source, the death toll at the hands of U.S. drones is over 4,700.<sup>3</sup> Further, Columbia Law School Human Rights Institute estimated that certain platforms kill 50 civilians for every one terrorist that is successfully targeted.<sup>4</sup> Although the accuracy of these reports may be questionable, depending upon which agency is conducting the briefing, it is not surprising that public sentiment is less than favorable for the use of drones within the confines of the borders of the U.S. Moreover, with these types of headlines, fear has become a motivator for citizens to become vocal about restricting or prohibiting domestic UAS operations.

The push for UAS operations is being presented by a variety of fronts but the most significant is probably that of Congress. In the most recent Federal Aviation Administration (FAA) Reauthorization Bill, a deadline of September 30, 2015 was set for integration of UAS in domestic airspace.<sup>5</sup> With this action, many government agencies have attempted to gain access to UASs and begin to operate them. Manufacturers and universities have also sought to begin testing and flying UASs so they can be prepared for the 2015 deadline. The FAA attempted to follow the orders of Congress by beginning to select test sites which would allow operators tremendous flexibility in the testing and flight of drones. Yet, tremendous public pressure coupled with the media and certain political action groups (e.g. Code Red and the American Civil Liberties Union [ACLU]) forced the FAA to delay the decision due to privacy concerns.<sup>6</sup> Even in light of this setback, UASs are currently being used by several government entities. The Federal Bureau of Investigation (FBI) recent admitted to using drones in domestic surveillance.<sup>7</sup> The U.S. Border Protection Agency also regularly uses UASs to patrol areas along the border. This particular agency also lets other law enforcement entities “borrow” its drones.<sup>8</sup>

With all of these occurrences, public outcry has elevated on the flight of UASs. Yet it is still unclear what types of drones and how they may be used that may be tolerable by Americans. Before moving forward with regulation and allowances for drone use, it is important to gauge what the public is willing to accept. Without doing so could lead to protest in the form of calling upon legislators, civil rights groups, and demonstrations. Further, the smooth transition of UAS operations within the U.S. necessitates some idea of what the average person is willing to accept. Perhaps just as important is realizing what the average American knows or believes about UASs so they may be better educated for the upcoming domestic integration of the systems.

## REVIEW OF LITERATURE

While there is a tremendous amount of literature on use of UASs in war zones and on public opinion thereof, the focus of this study was on the public opinion of U.S. citizens on the use of UASs within the confines of the borders of the U.S. Only a limited amount of exigent literature exists on this specific topic.

## Public Opinion on UAS

Considering the press headlines about UAS use, it is not surprising that public sentiment is not necessarily favorable concerning drone use within the U.S. It does appear, however, that citizens are less concerned about their safety as they are about their privacy. According to the Washington Times, one-third of the public fear for their privacy at the hands of police.<sup>9</sup> Fox News reported that the FAA permit process coupled with news reports have created “predictions that multitudes of unmanned aircraft could be flying here within a decade raising the specter of a ‘surveillance society’ in which no home or backyard would be off limits to prying eyes overhead.”<sup>10</sup>

*Protests.* There have been numerous protests about UAS use. The overwhelming majority of these instances concern the use of deadly force by these systems in foreign countries. There have, however, recently been some unrest concerning domestic UAS operations. In Seattle, the local police department intended to brief the public on the proposed use of drones for patrol and surveillance. The department was met with aggressive protest including chants that drowned out the police presentation. The Seattle Police Department decided to scrap plans for UASs following the outcry.<sup>11</sup> Another set of protests was organized to take place at drone manufacturing sites and Air Force bases in March of 2013. This was specifically to object to the use of UASs within the U.S.<sup>12</sup> Arrests have been made during at least one protest event. In April of 2013, 31 people were arrested while dissenting UAS use at an Air National Guard Base in Syracuse, New York.<sup>13</sup> Protests have also taken place outside the White House.<sup>14</sup> Considering the high visibility of such occurrences there may be presumptions of widespread public support for such events. Yet the only way to truly gauge support for such dissension is through public opinion polling.

*Opinion polls.* Although the movement to gauge public opinion about UAS operations is still in its nascent stage, there have been a few attempts to assess the topic. Rasmussen Reports conducted a telephone survey of 1,000 likely voters in early 2012. Over 76% of respondents supported UAS use overseas but only 48% found domestic flights acceptable. Half of those surveyed stated they believed that the President had sole authority to use drones.<sup>15</sup> A Fox News poll found similar data with 74% accepting of the use of deadly force to kill terrorists in a foreign country whilst 45% believed it was ok to use deadly force against terrorists even if on U.S. soil.<sup>16</sup>

In June of 2013, the Aerospace Industries Association sponsored a survey conducted by the Christian Science Monitor in which 4,895 responses were collected. A majority of individuals had a high level of awareness of UAS operations and 54% agreed that increased use of non-military UASs would be acceptable. If privacy issues were properly addressed, 74% would accept increased use. Sixty percent of those surveyed were concerned about privacy if UASs were utilized within the U.S. Over 60% of respondents believed that unmanned surveillance was equivalent to manned versions. The highest level of support existed for border protection missions (68%) while 62% accepted law enforcement usage.<sup>17</sup>

A poll by the Institute for Homeland Security Solutions looked into both public and first responder opinions. Partially internally and partially externally funded, this study queried 748 first responders which resulted in 119 (15%) responses. An additional 2,119

(of 3,623 [58%] prompted) persons from the general public were surveyed via an existing network maintained by Monmouth University. In this study 44% were not well informed about UAS operations proposed in the U.S. Approximately 57% supported their use in any application with 67% supporting homeland security missions, 63% for crime prevention, and 88% supporting search and rescue duties. Less than half, 43% stated regular UAS flights over the U.S. would be supported. Sixty-seven percent of respondents were concerned about surveillance of homes. Three-fourths of those surveyed supported government regulation of UASs.<sup>18</sup>

One of the most comprehensive public opinion inquiries was conducted by Monmouth University in the summer of 2012. Fifty-six percent of 1,708 respondents knew some or a great deal about unmanned surveillance operations. A significant majority, 80%, supported UAS use in a search and rescue mission role, 67% would support criminal apprehension, and 64% supported UAS border patrols. In terms of privacy concerns, 64% of those surveyed were either very concerned or somewhat concerned.<sup>19</sup> While clearly some opinions have been gathered on the use of UASs in domestic airspace, more specific data is necessary. In particular the types of platforms and broader ranges of use should be evaluated for public support. Also, confirmation of public knowledge of unmanned programs needs to be evaluated in order to assess public education campaign potential.<sup>15,16,17,18,19</sup> This study sought to extend this knowledge and to create and pilot an instrument that could be utilized in a subsequent broad reaching public opinion investigation.

## **METHOD**

The first step of this study was to create a pilot survey instrument through an exhaustive literature review and an analysis of existing instruments designed to study public opinion. Once the instrument was refined into a draft form, a qualitative analysis of the validity of the survey was conducted using an inquiry posed to a panel of experts. The principle source of data for this component was extracted emails and written feedback on the instrument.

### **The Survey Development Process**

The step-by-step instrument development process presented by Prochaska-Cue<sup>a</sup> was utilized to assist in the development of the survey. This process calls for the researcher to:

1. define objectives
2. define the target population
3. review related measures
4. develop an item pool
5. prepare and pilot a prototype (Prochaska-Cue, 1988, pp. 50-51).

A development checklist outlined by Creswell (2003) was also used to help model the development of the survey instrument for this study.<sup>b</sup>

*Definition of Objectives.* First, the objectives of the current study were defined. The goal of this study was to develop a survey instrument to identify public opinions related to the

use of UASs in domestic airspace. Opinions concerning specific types of platforms and operations were also sought.

*Definition of the Population.* The definition of the population for this instrument was somewhat complex. The purpose of the instrument was to collect data on a representative cross-section of the U.S. population. Due to the fiscal and time constraints of this study, only a small sample was able to be utilized ( $n = 223$ ).

*Review Related Measures.* The next step involved researching existing instruments.

A complete draft survey was constructed by the authors which was then delivered to non-participating higher education research faculty. This process was initiated by sending the study survey to five individuals via email. All were familiar with aviation higher education and UASs. Further all had advanced degrees and were familiar with survey research.

Overall, the respondents made positive remarks about the draft survey. As a result of the feedback, several questions were eliminated or reworded and the choice to place the final survey online with automated skip patterns was further solidified.

*Development of an Item Pool.* Through an analysis of the aforementioned instruments and input on the initial draft, an updated pool of items was developed to measure demographics and opinion based questions related to UAS operations. A checklist was developed based on the standards advocated by Creswell and were applied to each question.<sup>b</sup> Examples included:

- The use of questions that require an answer
- Questions that do not tax the ability of respondents to recall data
- The avoidance of double-barreled questions
- The avoidance of leading questions.<sup>b</sup>

For the sake of ease in coding and for standardization purposes, close-ended questions were preferred however to insure the completion of the survey, most questions allowed for a “prefer not to answer” option, as recommended in a variety of survey literature.<sup>ab</sup> Once a list of questions was compiled, each item was evaluated for simplicity and understandability. The most succinct options were retained.

*Preparation of and Piloting of a Prototype.* Upon completing the collection of the item pool, each question was placed into related category sections for clarity to assist the ease of respondent participation.<sup>bc</sup> Four primary sections were created:

- Familiarity with UAS operations
- Comfort level: Platforms
- Comfort level: Usage
- Demographics

Questions related most directly to participant occupations, those most likely to be of interest to respondents, were placed at the beginning of the survey. The most sensitive

questions, those dealing with demographic attributes, were placed at the end of the survey.<sup>c</sup>

The evaluation of the prototype version was conducted through the enlistment of a panel of experts. Panel inputs were recorded using email and written feedback. According to Prochaska-Cue (1988), a panel of experts can be used to “establish content validity” (p. 77) and whether questions meet the objectives of the instrument.<sup>b</sup> Expert panels were also helpful in “providing independent review, critique, and suggestions” for surveys (Finley et al., 2003, p. 830).<sup>d</sup> This literature guided the conduct of the consultation of a panel of experts in a review of the survey.

*Panel of Experts.* Nonrandom, purposive sampling was utilized as Berg (2007) defined this type of sampling as when “researchers use their special knowledge or expertise about some group to select subjects” (p. 44).<sup>e</sup> The panel of experts utilized to evaluate the survey consisted of ten persons selected with the requisite skills and backgrounds (advanced education, demonstrated proficiency in research methods, and online survey experience) needed to adequately evaluate the survey instrument.

*Feedback and revision.* Expert panel input was utilized to finalize the survey instrument. Some minor changes to wording were completed. Also, one panel member suggested a change to a picture in the survey. This was revised accordingly. A final version of the study was then made available on Survey Monkey.

## **Participants**

Due to the limited fiscal support for this study and the limited time constraints imposed from an external deadline coupled with the need to try to reach a random, cross-section of the U.S. population, a proprietary email list of 100,000 individuals was purchased from a public opinion data vendor. It became readily apparent upon the initiation of the survey process that this list was of poor quality. Approximately 48% of email eventually bounced or generated a similar error message. On average, less than 10% bounce rate is considered to be a “legitimate” mail list.<sup>f</sup> It is likely that even more email addressed were outdated or those that bounced were filtered by the researcher’s spam filtration system. Thus a very poor response rate of 0.4% ( $n = 223$ ) was received and deemed usable. While the number of responses was not as high as expected, the fact that this study was intended as a pilot for a later, wider-reaching study still makes the findings of interest. It also does provide some insight into the variance in opinion from one study to another.

## **Data Analysis**

Data analysis was conducted using the Survey Monkey analysis tool. Results were then downloaded for description in this study. No inferential or other types of statistical analysis were conducted. This data will be retained for potential further use and comparison with future data collection.

## RESULTS

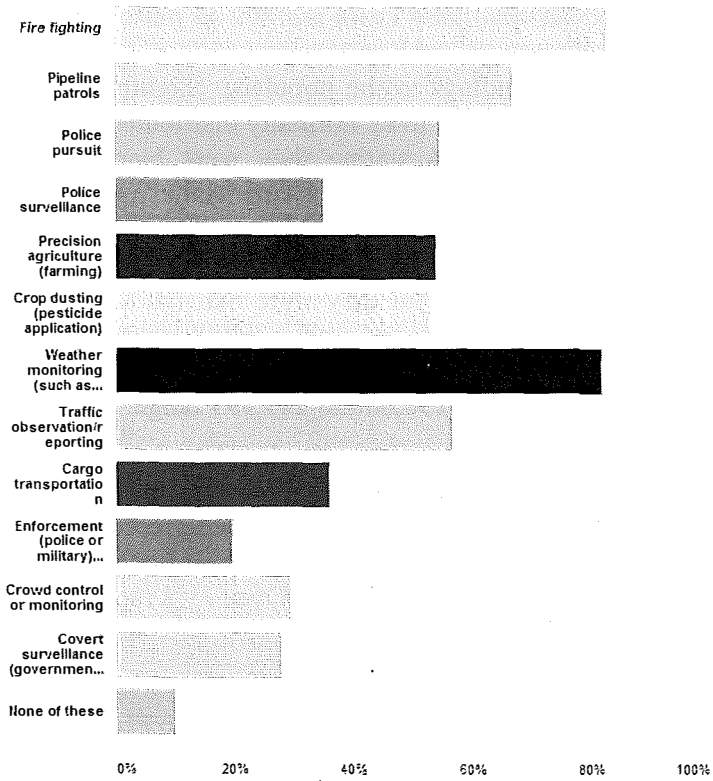
Questions were organized in groups of related topics. The first series evaluated public knowledge of UAS operations. When asked if individuals were familiar with the use of UASs by the military and other agencies, 95% of respondents said “yes.” When asked about the specific types of missions conducted by UASs, 87% replied “familiar” or “very familiar.”

The survey next inquired into what types of platforms are associated with the term “drone” to assess public knowledge and opinion of actual UASs used in current field operations. The first image shown to the respondent was that of a small model remote control (RC) type helicopter. Over 78% stated that this type of device did not match or somewhat did not match the appearance of what the respondent assumed to be a “drone.” The next image showed a Predator-type jet powered UAS firing a missile. For this image, 95% stated that it matched the expected appearance of a “drone.” The subsequent picture was of a commercial quad-copter with a mounted camera. Only 66% said that this platform somewhat matched or exactly matched their expectations of a “drone.” A small fixed wing aircraft was shown being hand launched from a field in the last platform question. An overwhelming 67% answered that this type of vehicle did not match or somewhat did not match what they thought of as a “drone.”

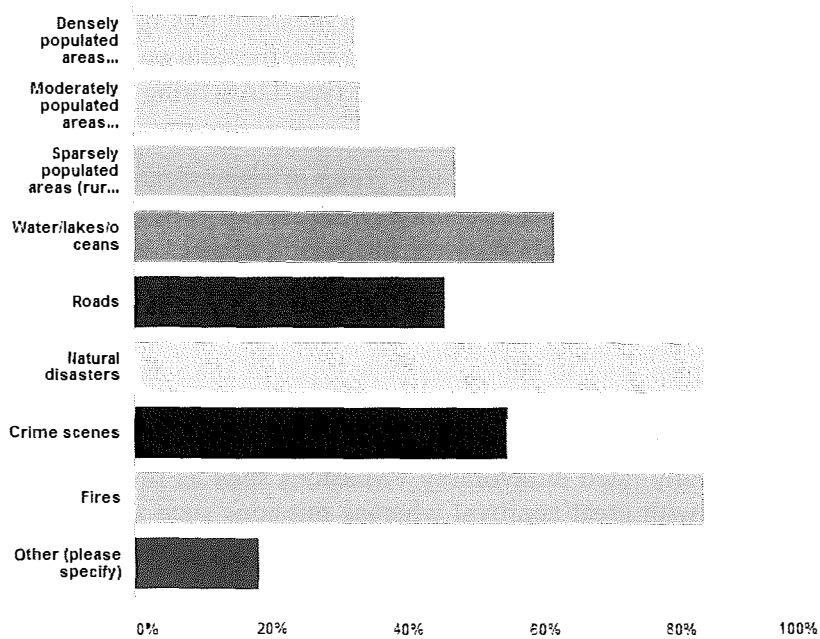
The subsequent set of questions investigated personal comfort levels of specific types of missions. Fifty-three percent stated that they were “slightly uncomfortable” or “very uncomfortable” with domestic use of drones outside military controlled airspace. When asked what types of missions would be acceptable to respondents, there were high levels of support for firefighting, weather monitoring, and pipeline patrol. See Figure 1 for complete results. When asked about the types of platforms that the respondent would be comfortable seeing in U.S. airspace, 63% stated the quad-copter type would be agreeable, 58% would find the small helicopter type reasonable, 55% were comfortable with the small fixed wing aircraft type, whilst only 24% accepted the Predator-type militarized platform.

Questions then asked about privacy concerns. A majority, 67%, were either “very concerned” or “concerned” about privacy. When asked what concerned the respondent the most about domestic UAS flights, 47% said “privacy,” 38% said “safety,” with the remainder being concerned about some “other” type of issue. When asked about if the government should regulate domestic drone usage, 88% stated that this was “very important” or “slightly important.” Individuals were queried about if they would be comfortable with UAS flights within the U.S. if proper safeguards were put into place concerning the use of data that was collected during surveillance flights. Approximately 40% said yes, 27% said no, and the remainder were “not sure.” When asked what types of geographic areas respondents would feel tolerant of UAS overflights, over 80% stated over natural disasters and fires would be reasonable. See Figure 2 for complete results.





**Figure 1. Acceptable types of UAS missions.**



**Figure 2. Acceptable types of geographic areas for UAS missions.**

Demographics indicated an equitable cross-section of persons with different backgrounds. No comparisons were made with the general U.S. population thus it would be inappropriate to generalize the findings to the populace. Slightly more than 66% of respondents were male and ages appeared to be normally distributed from 21 to 80 and older. Most (81%) were white, with 6% stating they were black, 5% American Indian/Alaskan Native, 2% Asian, and the remaining either other races or prefer not to answer. The sample was well educated with 30% holding master's degrees, 23% bachelor's and 16% with doctorate degrees. All respondents had at least a high school diploma or equivalent. Fifty-six percent indicated that they were married and 62% were employed full-time. Even distribution of income existed from \$20,000 per year to 149,999 (average of approximately 13%) with very small percentage above 250,000 (1%), and about 8% in the sub 19,999 category and 5% in the 150,000 to 249,999 range.

Respondents were fairly evenly geographically distributed (averaging 10%) with the exception of the South Atlantic which had higher representation than the average (21%), and the East South Central area which was seemingly underrepresented (3%). The highest number of those surveyed identified themselves as political "independents" while 25% were "democrat" and 21% were "republican." Over 73% reported that they had never served in any military branch.

## DISCUSSION

Some points that can be drawn from this data are that the individuals who responded to the UAS survey were 1) very familiar with the use of UAS by the military and other agencies (95%), and 2) were very familiar with the specific types of missions conducted by UASs (87%). That being said, some of the data obtained was fairly predictable. Considering that most of the respondents answered the way they did on the first two question, it is not surprising that 95% identified a Predator type UAS firing a missile as matching their expectations of a drone.

Another point that can be drawn is that this group of respondents is fairly well educated. Sixty-nine percent of the respondents had some sort of college degree. Thirty percent reported master's degrees, 23% reported bachelor's degrees, and 16% reported doctoral degrees. That being said, this sample of the population is probably up to date on current events and knowledgeable about technology in general.

Of interest are the responses to the "acceptable types of UAS missions." For the most part, UAS missions that had implied service of benefit to the community were rated favorably whereas UAS Missions that implied surveillance or covert activity by law enforcement were generally rated unfavorably. Missions such as firefighting and weather monitoring were met with great approval whereas missions such as police enforcement, crowd control and covert surveillance were met with significant disapproval.

The general consensus is that this group of respondents agrees with beneficial uses for UAS technology and disagrees with potentially intrusive uses that potentially violate and individual's right to privacy. This is not surprising given the recent outrage expressed by the public and some political figures condemning the use of drones for surveillance

against U.S. citizens. The right to privacy and Fourth Amendment protections are top priorities in today's society. Covert surveillance by law enforcement agencies is generally frowned upon.

## CONCLUSION

The limitations of the study must be taken into account when trying to draw conclusions from this data. The major questions to ask revolve around generalizable to the general population. This study was intended as a pilot study to develop, validate, and test the distribution system for future, more detailed studies. As discussed earlier, demographics indicated an equitable cross-section of persons with different backgrounds. No comparisons were made with the general U.S. population thus it would be inappropriate to generalize the findings to the populace. Further research is needed for more extensive data collection on this important topic.

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