

Comparative Analysis of Small Unmanned Aircraft Systems Operations Manuals

Stephen M. Cigal



Introduction

With the FAA's rulemaking for sUAS, there has been a rapid growth of this industry:

- sUAS Growth has produced over 100,000 Remote Pilot Certificates by mid-2018
- sUAS growth is expected to be sustained at greater than 40% through 2030
- An estimated \$82 billion-dollar impact in the economy by 2025



Introduction

The public has concerns regarding pilot experience, safety and maintaining privacy as recorded prior to the rulemaking.

- One company was concerned about what damage or injury could be done with a sUAS
- Pilot experiences and knowledge can degrade over time placing them in riskier situations
- Public privacy is not addressed in 14 C.F.R Part 107, leaving the existing State statutes to address the concern



Key Terms

Currency (Recent Flight Experience) means that the PIC of an aircraft carrying passengers or certified for more than one pilot crewmember must make at least three takeoffs and landings within the preceding 90 days. The person must have acted as the sole manipulator of flight controls and done so in the same category, class and type aircraft. 14 C.F.R. § 61.57

Pilot in Command (Remote Pilot in Command) is the operator of the aircraft (sUAS) who holds a remote pilot certificate, has final authority and responsibility for the operation and safety of the flight, has been designated as pilot in command, and is responsible for compliance with 14 C.F.R. regulations. 14 C.F.R. § 107.19

Proficiency means the pilot is knowledgeable and capable of aircraft normal and emergency operations as well as types of flight for that airframe. An evaluation is required to certify that the pilot is proficient at that aircraft's operations. 14 C.F.R. § 121.441



Why is this important

With the public's request for safe and private operation of sUAS, what are companies doing to address this?

A company's operating manual is designed to describe how the company conducts its business, specifically:

- **Who is responsible for what**
- **Routine operations**
- **Emergency procedures**
- **Methods to manage risk**
- **Training requirements & methods to maintain knowledge/skills**
- **Special items as required by local operating areas**



AUVSI TOP Certification

Trusted Operator Program – a certification process that seeks to ensure sUAS operations are safe, professional, and reliable while taking into account risk and human performance

- Three levels of certification

TOP service providers are required to have:

- Operating procedures
- Management systems
- A training program
- A safety program



Data Set: Specific OM's

Governmental		Commercial	Universities
AL DOT	Minnesota DOT	Cambridge Drone Services	ERAU
California Dept Water Resources	NC DOT	Gowdy Brothers	ESI Drone Lab
California Dept of Fish and Wildlife	NOAA	Hover	Northumbria University
City of LA Public Works	Seattle PD	Lone Star UAS	Southern Illinois
Fairfax County VA	Texas Dept of Safety	Mountains Rec	U of California
Gaithersburg MD	Texas DOT	Piper Mountain Aerial	U of Colorado
Menlo Park FD	Thurston County WA	SkySwoop	U of Michigan
Miami-Dade PD	USA Dep of Interior	Southern Co	U of Wyoming
Wichita Police Department	York County VA	UAV America	



Methodology

35 operating manuals from universities, state government operators, federal organizations and commercial sUAS operators flying under either 14 C.F.R Part 107 or a COA were analyzed.

Quantitative data from any recent flight experience was analyzed in Microsoft Excel and compared to the three takeoffs and landings every 90 days required for pilots of manned aircraft under 14 C.F.R. Part 61.

Qualitative data was analyzed to determine to what extent OM's address training, privacy, battery and environmental efforts, as well as methods to increase safety during flight.





Methodology

1. Are their requirements for recent flight experience (currency)?
2. Does the company address privacy concerns?
3. Does the company specify initial and recurrent training requirements?
4. Is there an imposed flight distance restriction too people?
5. Does the OM address the unique characteristics of lithium batteries?
6. Does the OM contain additional methods to increase safety during a flight?



Assumptions & Limits

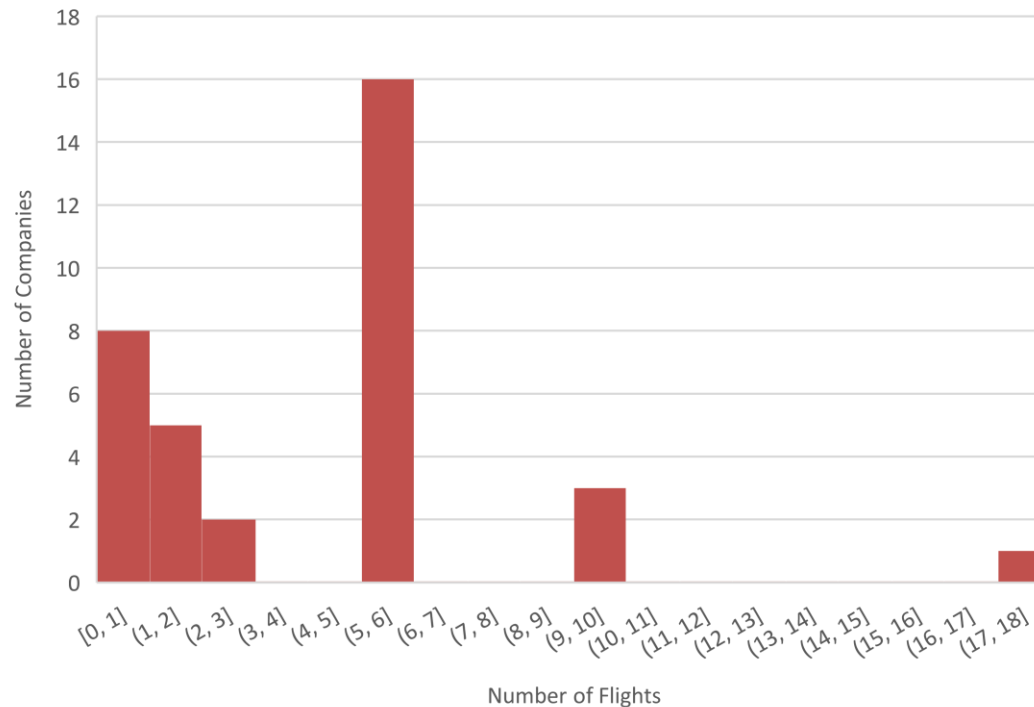
1. 30-minute flight time used in absence of any specified aircraft.
2. Limited data set available made publicly
 1. Many companies protect their OM due to their competitive nature
3. Airframe specific manuals excluded
4. Only one researcher to categorize data from OM's
5. Majority of OM's from United States
 1. Three (9%) were from United Kingdom



Analysis

Mean flights per 180-day period is 4.6 ($N = 35$, $SD = 3.8$)

- 46% of companies defaulting to the FAA's manned requirements of 6 flights per 180 days.
- However, 23% did not specify any currency requirements



Analysis

Additional initial training was required by 77% of the companies

- However, only 43% had any recurrent training requirements

Privacy and battery requirements were addressed equally by 47% of the companies ($N = 34$)

Forty-one percent of companies imposed minimum distance between people and the aircraft, however there was no consistency of distance

Fifty-six percent of companies used emergency procedures as a method to increase safety during flight operations.

Analysis

	Governmental	Commercial	Universities
Percent of population	51%	26%	23%
Flights per 180 days	5.1	4.2	3.9
Used EOP's	55%	78%	57%
Privacy Concerns	50%	56%	29%
Initial Training	89%	78%	57%
Recurrent Training	61%	33%	14%



Comparing the 34 Operating Manuals that were provided with full data, only 24% of them could be considered for the AUVSI TOP Certification Level 3.

Conclusions

1. Although industry organizations have laid out the framework for training, there is no consensus towards a minimum number of flights or specific training requirements.
 - Research shows that frequent flight manipulations and a strong number of hours as a pilot can reduce the likelihood of a mishap
2. Only half the companies employed emergency operating procedures to increase safety during flights
3. Less than half the companies addressed methods to limit gathering of private information

Recommendations

1. Expanding the data set to include a more equal distribution of companies
2. International exposure to companies
3. Companies wishing to incorporate sUAS technologies into their business should consider **AND ADDRESS** the following questions:
 - What educational requirements do your pilots need and how are they to be maintained?
 - What emergency procedures should be in place to protect people and equipment?
 - What methods should be deployed to limit collection of personal data?



Acknowledgements

- Dr. Robert Joslin for his guidance, recommendations, patience and insight into the FAA for someone without flight experience
- Embry-Riddle Aeronautical University - Worldwide
 - Professors, Instructors, and Staff