December 11, 2020

Mr. Brandon Roberts
Executive Director, Office of Rulemaking
Designated Federal Official, Aviation Rulemaking Advisory Committee
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

RE: Airman Certification System Working Group (ACSWG) Interim Recommendation Report

Dear Mr. Roberts,

On December 10, 2020, the Aviation Rulemaking Advisory Committee (ARAC) unanimously voted to accept the Interim Recommendation Report submitted by the Airman Certification System Working Group (ACSWG). This report includes suggestions and recommendations for changes to the FAA Unmanned Aircraft Systems Operating Handbook.

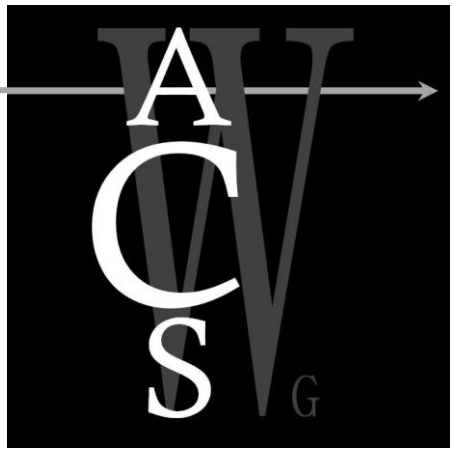
On behalf of the ARAC members, please accept the ACSWG Interim Recommendation Report, submit to the relevant program offices and move forward to the establishment of a public docket.

Please do not hesitate to contact me with any questions. Thank you very much.

Sincerely yours,

Yvette A. Rose
ARAC Chair
202.293.1032
yrose@cargoair.org

cc: David Oord, ACSWG Chair and ARAC Vice Chair



Aviation Rulemaking Advisory Committee

Airman Certification System Working Group

Interim Recommendation Report

November 9, 2020

November 9, 2020

Yvette A. Rose
Chair, Aviation Rulemaking Advisory Committee
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

Dear Ms. Rose,

On behalf of the Airman Certification System Working Group (ACSWG), we submit the following interim recommendation report to the Aviation Rulemaking Advisory Committee (ARAC) for consideration.

The ACS working group reviewed the new FAA Unmanned Aircraft Systems Operating Handbook – which you can access here.

This new FAA-H-8083-24 will be replacing the Remote Pilot – Small Unmanned Aircraft System Study Guide (FAA-G-8082-22) and will be used to support the Remote Pilot Airman Certification Standards (FAA-S-ACS-10A) and FAA Knowledge Exams (you can view practice tests here for these tests).

The Remote Pilot tests are the most FAA Knowledge Exams now given – exceeding even the volume of Private Pilot tests given and supporting the more than 1 million registered drones sharing the National Airspace System (NAS) along with the manned aircraft. This new FAA-H-8083-24 will be a very important handbook to facilitate training and testing of Remote Pilot airman.

This latest review and suggestions for improvement represent the FAA and the aviation industry's continued effort to improve airman training and testing. That collaboration has continued despite this difficult and unprecedented time. The result of this work adds to and continues to improve the new integrated, holistic airman certification system that not only aligns testing with the certification standards, guidance, and reference materials, but also maintains that alignment.

Representing the dedicated aviation professionals and members of the working group, we fully support the committee's transmittal of these recommendations to the FAA for further review, incorporation, and implementation. We are confident that, by doing so, the safety of aviation will continue to markedly improve.

Sincerely,

David Oord
ACSWG Chair
Head of Regulatory Affairs Americas
Lilium

Susan Parson
FAA Representative
Flight Standards Service
Federal Aviation Administration

Jackie Spanitz
UAS Handbook Review Lead
General Manager
Aviation Supplies & Academics, Inc.

FAA Unmanned Aircraft Systems Operating Handbook - FAA-H-8083-24
ACSWG Suggestions and Recommendations

- Increase margins on all 4 side of the page layout; when printed, the information is getting lost in the gutters.
- Front page numbering is off; 3 pages are numbered i and ii. Normally the title page would be i and the rest of the pages would be numbered sequentially with blank left-pages (i.e. Preface ii, Acknowledgements v, TOC vii, etc.)
- Page numbers are in the left and right corners, which implies there are left and right pages; however, blank pages were not included. Suggest adding blank pages so new chapters start on right-facing page.
- Part 107 regulations were split up and discussed in various chapters; however, it would be helpful to have a dedicated chapter on Regulations to provide an overview and perspective on 14 CFR and applicable regulations (Part 107, 91, etc.).
- Overall, specifically Ch 1, 2, 7, 11, 12 - Numerous spelling, grammer, organization, and other issues exist throughout the document. These were too numerous to highlight.
- Pg VII Chapter 5 Contents - “Winkel” should be “Wankel” This is a universal change as this error occurs several times.
- Pg 1-1, first para – add comma family, building
- Pg 1, History, A section on history should not be included in the document. This is an operating handbook. We don't read about the history of airplane development in a POH. Remove history section.
- Ch 1, all: The entire chapter needs extensive revision for grammer, mechanics, tone, spelling and person.
- Ch 1, all: Author assumed reader already understands aviation terms without first introducing them, e.g., sUAS, Class G airspace, etc. Define terms when they are first introduced into the text, rather than having readers consult the glossary which interrupts the natural flow of the reading.
- Pg 1-1, spelling: The integration of sUAS harkens back to the beginnings of model aviation; suggest spelling out small Unmanned Aircraft System (sUAS)

- Pg 1-1. The last two sentences in the Introduction paragraph reference recreational flight which was limited to designated areas. As the FAA Remote ID Final Rule is due out in December 2020, I would recommend deleting any reference to designated areas because if the RID Final Rule is close to the NPRM, there will ONLY be designated flying areas for non-RID equipped UAS. Hopefully this won't be the case. Given that imminent release of the RID Final rule, simply dropping any reference to a designated flying area would allow this section to be correct after the RIF Final Rule is released. Also in the last sentences of the Introduction a reference is made that kits are available for less than a meal. While multirotor toys can be purchased for under $50, most recreational UAS cost in the range of $250 to $2,000. We this handbook is focused at the operator of these $250 to $2,000 sUAS for recreational and part 107 use and therefore a reference to "less than the cost of meal", is a turn off and would make the reader feel the Handbook is not aimed at them if they are flying more sophisticated UAS. This could be fixed simply by leaving cost out of the sentence.
- Pg 1-2, History, Ryan Q-2C Firebee. The last sentence of this section reads, "The evolution of technology has been accompanied by a progression toward integration and inclusion, which continues today." This sentence made me jump out of my seat. From a recreational and part 107 perspective, the FAA has not been inclusive and the integration of UAS into the NAS has been slow and guided by manned aircraft associations and manufacturers. The organizations the FAA is supposed to listen to including the ARC, ASSURE and DAC have been ignored when it comes to recreational and part 107 UAS. Instead of including a statement that is controversial to us, we suggest simply removing the words, "and inclusion" in the last sentence and focus exclusively on technology.
- Pg 1-3, General Operating Safety. Page 1-3 talks about types of UA. As you also pointed out a few times this is not important and they actually contradict themselves a few times in this document. They start by saying a drone is a VTOL. No one calls a multirotor drone a VTOL. People use the term VTOL for the hybrid that takes off vertically but then flies aided by a wing. The document later talks about VTOL being hybrid later on on pate 2-3 under designs.
- Pg 1-4, missing descriptor; "Fly at or below 400 feet," Add: above the ground level (AGL)
- Pg 1-4, General Operating Safety. The third bullet reads, "Register your aircraft with the FAA, if needed." We suggest this could be changed to this and cover all cases for registration for recreational and part 107 use, "Register your aircraft with the FAA if: The intended use is recreation and the weight is greater than 0.55 pounds and less than 55 pounds. Or, if you intend to use the sUAS for part 107 operation." The fifth bullets reads, "Fly in Class G airspace only, unless you are granted approval by ATC or via a waiver." This is no longer correct. This should read something closer to, "You may fly in Class G airspace without authorization. You must gain a waiver, a COA or near real-time approval via LAANC to fly in any controlled airspace."
- Page 1-4 they talk about the recreational test. I know Kevin Morris talked about giving that test an official name. If one has been chosen it should be used here.
- Page 1-4 They mention staying under 400', they should probably state something about that being for uncontrolled airspace and that the ceiling may be lower in controlled airspace.
- Pg 1-5, General Operating Safety. Page 1-5 when they are talking about reporting an accident, they should mention the $500 minimum here as well.
- Page 5, first sentence. What is a basic pilot? I suggest revising "basic" to "remote"
- Page 5, second sentence. This statement is misleading. I suggest revising to, "This handbook is for remote pilots operating for both recreational and commercial purposes, and this handbook distinguishes the differences between the two."
- Page 21, first sentence in Unmanned Aircraft (UA) Defined by Weight and Design section. UAS is not yet defined in section 1.1. Remote ID has proposed a UAS definition, but I don't think it includes this statement. I suggest deleting this sentence.

- Page 22, first sentence in Takeoff Weight Over 55 Pounds section. “Weighing over 55 pounds” is not technically accurate. I suggest revising to "weighing 55 pounds or more"
- Page 25, first sentence of Control Systems section. I suggest revising "A remote pilot in command (rPIC) maintains control" this to "A remote pilot maintains control". The remote PIC may not be controlling it, it could be another person on controls.
- Page 125, Class A Airspace section. Most readers of this document probably have no idea what IFR clearance means. Perhaps you could simplify this section. I suggest revising the section as follows, "Class A airspace exists above 18000 feet MSL, which is much higher than the limits of Part 107 for small UAS operations. So Class A airspace will not be covered any further in this handbook."
- Page 127, second to last sentence of Class G Airspace section. This statement makes a strong implication about future actions that are uncertain. I suggest revising "can and probably will" to "may".
- Page 137, general comment on the second paragraph in Aircraft Call Signs section. Several websites and applications exist that allow the public to listen to radio communications in the NAS. The AIM also contains useful information about ATC phraseology. Perhaps these should be included in this paragraph as additional resources.
- Chapter 2, Various sUAS Categories, Components and Systems, pp 2-1 and 2-2. The title of the bulleted list reads, “…provides the following definition for the individual components of sUAS:” The bulleted list is of different types of sUAS but not a description of individual components.
- Pages 2-1 and 2-2. They mention that the FAA classifies anything between .55 pounds and 55 pounds as sUAS. I thought the FAA said anything under 55 pounds was as sUAS with no lower limit.
- Pg 2-1, UAS definition is too broad. It describes all aircraft. Narrow the definition.
- Chapter 2. This chapter could be simplified greatly by removing descriptions of fixed wing and rotorcraft. While we understand these are relevant sUAS, if the target audience of this Handbook are recreational and commercial sUAS operators, the overwhelming majority of sUAS are multirotor aircraft.
- Chapter 2, Rotorcraft, 3rd paragraph, pp 2-4. The last sentence in this paragraph is obsolete. It could read, “However, while the mechanical design is simplified when compared to the rotorcraft airframe, the electronic complexity is greatly increased in complex flight controllers and speed controller (ESCs)”
- Chapter 2, Airframe Materials, 1st paragraph, pp 2-4. The second to the last sentence reads, “Common materials are plastic, aluminum and composite materials including fiberglass and carbon fiber.” We suggest this is obsolete and should be changed to read, “Common materials are carbon fiber and composite plastics.” As a reference, video drones (e.g. DJI) have a plastic composite frame and a plastic composite shell. FPV and Racing drones are virtually all carbon fiber frames without any shell or body. References to fiberglass and aluminum may be removed. While some sUAS in the 20 to 40 pound magnitude use aluminum, the volume of these drones as a percentage of the total is tiny.
- Pg 2-5, Materials. Section on materials covers aluminum as the only metaillic component. It is the most commonly used but it is disingenuous to the reader to be the only metallic of mention - there should at least be a general metallics category. This is especially important when considering that the next material discussed is carbon fiber composites which should never be used in conjunction with aluminum unless very very specific mitigations are considered due to galvanic corrosion issues. Also discussed is that carbon fiber has "high-temperature property retention" which is almost completely dependent upon the resin system used and not the fiber used - not all resin systems have good high-temperature property retention and many resin systems easily available for home builder applications have terrible termperature property retention. Carbon composites are also highly combustible under the right circumstances which is not conducive to good property retention at high termpartures. Add Titanium to the materials discussion, as well as a general section on metallics.

Add a galvanic corrosion discussion under the use of carbon fiber composites.

Remove the incorrect statement that carbon fiber has high-temperature property retention and replace with a section discussing various resin/matrix properties for use with composite materials indicating that selection of the proper resin system is important for various properties such as high-temperature property retention - make clear that the properties of composite materials are specific to the type of fiber/fabric chosen along with the resin/matrix that it is used with. Add caution that composite materials and related resin systems are extremely flammable and that the exothermic reaction that takes place during a resin cure cycle is extremely flammable and prone to spontaneous combustion.

- Chapter 2, Control Systems, Transmitter, pp 2-5. The second sentence reads, “With few exceptions, control inputs for sUAS consist of two control sticks that control the flight surfaces of the UA”. If we consider a rotor a flight surface then no change is required. If on the other hand, we consider a flight surface an aileron, rudder, elevator, flap, etc., then we would want this sentence changed. The sentence could avoid a discussion on control surface and read, “Control inputs for sUAS consist of two control sticks that change throttle, yaw, pitch and roll.”
- Pg 2-6, 4th para – add “Title” 14 of the CFR
- Chapter 2, Control Systems, Transmitter, pp 2-6. The last two sentences in this section read, “The GUI gives the pilot telemetry data from on-board sensors. Information such as remaining battery, signal strength, altitude, ground speed, and live video provide increased situational awareness for the rPIC. While most drones feature limited controllability through the GUI, it is not common for the GUI to be the sole control source for he UA.” This is does not reflect the current state of either video, FPV or racing drones. I would suggest a sentence or two similar to this, “While the transmitter primarily sends command and control signals from the two sticks to the aircraft, newer transmitters as well as video receivers receive telemetry and video signals from the aircraft. The telemetry data may include battery strength, speed over ground, GPS coordinates and altitude. The video feed provides a First Person View for the rPIC as if he or she were sitting in the sUAS cockpit. The combination of integrated telemetry and FPV provides the modern sUAS with improved situational awareness.”
- Chapter 2, Control Systems, Radio Frequency, pp 2.-6. The second sentence in the first paragraph reads, “The RF bands used for UAS communication are the 2.4 GHz and the 5.8GHz bands. While RF use is regulated by the FCC, these bands do not require licensed use.” This is incorrect and needs to be changed. I propose this suggested wording, “The RF bands used for UAS communication are the 900 MHz, 2.4 GHz and 5.8 GHz bands. These bands are regulated by the FCC and require the rPIC to have passed a “Ham” radio test to be licensed. The exception is when the manufacturer gains an exception from the FCC for a specific product model.

  The third paragraph, second sentence reads, “…sUAS RF use typically falls within 5.8 GHz band while 28 GHz band is generally dedicated to photographic and video data transmission.” This is no longer the case. Today, 900 MHz is used for Command and Control and 2.4 GHz or 5.8 GHz are used for a combination of Command and Control and video transmission.”
- Page 2-6 As you mentioned they have problems with their definition of RF bands. The authors should be more generic here and state that sUAS might be using any unlicensed spectrum. I also like what you mentioned about the ham license stuff. The authors make it sound like ONLY 2.4ghz and 5.8ghz are ever used, which we know is very wrong.
- Page 2-6. The sentence that reads "sUAS RF use typically falls within the 5.8 GHz band while the 2.8 GHz band is generally dedicated to photographic and video data transmission. Refer to your sUAS user manual for specifics on RF use in your equipment." Makes no sense. Of course for fpv 5.8ghz is usually used for video and often 2.4 or 900mhz for control. But their sentence is missing some words and is not even understandable.

- Chapter 2, Control Systems, Flight Controller, pp 2-7. The first sentence reads, “A flight controller is an onboard device that can stabilize (and sometimes navigate) an sUAS depending on the available microprocessor, programming and sensors.” Today, a flight controller is more than this and I would suggest replacing this sentence with something like, “A flight controller is the brain of a sUAS. It receives input from the cameras, ESC, barometers, accelerometers, gyroscopes, as well as input from the command and control system and outputs corrected or filtered speed control signals to each motor as well as output reporting of telemetry data to be viewed on FPV goggles or a screen in use with the transmitter.” The remaining sentences in that paragraph may be deleted.
- Chapter 2, Control Systems, Voltage, pp 2-7. The first sentence reads, “Flight controllers generally run on either 0-3.3 volts or 0-5 volts so a battery eliminator circuit is generally used.” This is no longer the case with today’s technology. I would suggest replacing this paragraph with, “Flight controllers accept Li-Po voltage from one to six cells or 3.7 to 22.2 (nominal) volts. The flight controller powers a number of components and has a variety of voltage regulators to support these devices.”
- Chapter 2, Flight Modes, pp 2-8. The modes discussed in this section should be qualified to those modes limited to video drones. The hundreds of thousands of FPV and Racing drones do not use these modes.
- Chapter 2, Graphical User Interface (GUI), pp 2-9. This section is only relevant to more expensive video drones (e.g. DJI Mavic). FPV and Racing drones both use a GUI which is integrated into the rPIC’s goggles and is called an “On Screen Display” or OSD.

  The authors state "To overcome the reduced situational awareness".... This once again perpetuates stereotypes that are either not true or very open to argument. Many people would suggest that an FPV drone operator has MORE situational awareness than an average manned aircraft pilot.
- Chapter 2, Sensors, Payloads, & Accessories, Pitot Tube/Airspeed Sensor pp 2-11. This section should be deleted. I know of no sUAS that uses a pitot tube. Speed is calculated in sUAS by the flight controller calculating the difference in GPS over a set time period.
- Chapter 2, Visual Spectrum/Still and Video Cameras, pp 2-12. This section should include at least a sentence about FPV. The section describes cameras used for still and video which are secondary to command and control. FPV and Racing drones use specific cameras for command and control. FPV drones also frequently have a second camera to shoot video. An introduction to FPV should be made here as it is used in FPV freestyle, FPV Racing and with video drones (e.g. DJI Mavic).
- Pg 2-11, Figure 2-19 – do you really want to use callouts in French?
- Ch 3, The chapter reads well overall. It ends abruptly without a summary. Consider adding a summary paragraph.
- Chapter 3, Aerodynamics & Performance. I recommend only information relating directly to multirotor sUAS be retained in this chapter. As a mechanical engineer, I love the detail in this section. Putting myself in the mind of a new sUAS rPIC, I would likely be confused by the references and descriptions of theory of fixed wing and rotorcraft.
- Pg 3-2, remove stray dot at the end of the first line
- Pg 3-3, Lift equation, An increase in the denominator on the right side of the equation will result in a decrease of lift. In the sentence, "As can be seen in the equation . . . " replace the word "items" with "variables."
- Fig 3-8, The discussion on induced drag is referencing Fig 3-8. It should reference Fig 3-9. Make sure Fig 3-9 is correlated with the induced drag discussion, to include the discussion on low AOA at cruise speed. Consider re-ordering the points, paragraphs or the illustrations to accommodate.

- Chapter 4, sUAS Loading and Weight & Balance. Like chapter 3, I recommend only retaining information which is directly relevant to multirotor sUAS. For most modern sUAS, balance is only somewhat important as the flight controller will compensate for any imbalance. Weight is important to the rPIC as more weight will either reduce flight times or make the aircraft too heavy to fly.
- Pg 5-1, 5th para – change Winkle to Wankle
- Pg 5-2, 2nd para – replace “glow starter” with “battery”
- Pg 5-4, Figure 5-8 – replace “Winkle” with “Wankle”
- Pg 5-5, 1st heading - replace “Winkle” with “Wankle”
- Pg 5-6, Effects of Ethanol – 1. Change “engine stall” to “engine failure”
- Pg 5-8, Propellers; "Propellers are dangerous! The act of starting a small engine with an exposed propeller is one of the most dangerous aspects of flying sUAS." Propellers are dangerous for ALL aircraft including UAS that have them, not just "sUAS" remove s, i.e. UAS
- Pg 5-10, Starting Procedures #2 “comms”? I thought this is about UAS – who are you communicating with?
- Chapter 5, Powerplants, Fuel, & Batteries. I recommend only information on outrunner brushless motors and Li-Po and Li-Ion batteries be retained. There are very, very few sUAS which are powered by internal combustion engines.

  The section on Propeller Safety (pp 5-10) is fantastic and is incredibly important to sUAS operators.

  Also, the section on Li-Pos (pp 5-20) is great. Anything which can be done to increase the prominence of this section would be good.
- Pg 5-15, last para, second sentence. “maintenance is required for every hour of use?
- Pg 5-18, 2200 mAh equals 2.2 Ah – not 4
- page 5-20 The section on charging a lipo and the c rating on the pack is incorrect. The c rating on the battery label is the discharge rate, not the charge rate. This bullet point also contradicts their own example in figure 5-23.
- page 5-21. Storing a lipo above storage voltage has does cumulative damage to the battery for every second it is fully charged. I would change this to say that for maximum longevity for your battery, you should not leave a battery charged for more than 24 hours, or for as little time as possible. Later on they even mention something about 1-2 days.
- Pg 6-2, first line,2nd sentence – need a space after the comma
- Pg 6-21, Climb; Twice lift is referred to as "downwards thrust." Condier replacing "downwards" with "upward."
- Pg 7-3, Three Axes of Flight; Even though "bank" is somewhat accurate, motion about the longitudinal axis is correctly referred to as roll. This is the term used in Fig 3-13. Consider replacing the term "bank" with "roll."
- Pg 7-3, Suppression of "desire to fly" seems irrelevant. Explain why this is revelant or remove it.
- Pg 7-3, Waiting Period, Medication half lives relate to last doses. Half lives vary. Consult with the FAA Federal Air Surgeon and he will help you on this.
- Pg 7-3, visual field, I am unaware of evidence of this. Where is it? Some studies show that the ability to react to stimulus in the peripheral visual field is reduced. Absent evidence supporting this claim, consider, "may adversely affect peripheral vision."

- Pg 7-4, last para – rods, cones and fovea have not been previously mentioned or defined. This causes confusion for that have not studied anatomy
- Pg 7-4, Fig 7-2, scanning technique, Description and illustration don't match.
- Pg 7-4, Night blind spot, An explanation of eye anatomy is needed before these references are made. Insert information on eye anatomy.
- Pg 7-5, Scanning techniques (line 18), This is redundant. It is verbatim or nearly so to an earlier paragraph. Resolve redundancy.
- Pg 7-6, 20-20- vision, Some pilots demonstrate 20-10 and 20-15 vision. Delete superlative.
- Pg 7-6, turn away (line 38), somewhat confusing; consider using “avoid looking at”
- Pg 7-6, ground lights, Lines 44-49 are questions. Use question marks.
- Pg 7-6, 2nd para, third bullet – change insight to in sight (two words)
- Pg 7-6, 5th para, last sentence – This is not how hypoxic hypoxia is defined. This sentence would be more accurate – This is an effect of hypoxic hypoxia
- Pg 7-7, Alcohol, Techniques of night vision, Consider using " night flying techniques"
- Pg 7-8, Distance estimate, Retinal image size and aerial perspective are not described in the chapter. Explain these later or delete them from the paragraph.
- Pg 7-8, Motion parallax, It states "Motion parallax refers to the apparent motion of stationary objects as viewed by an observer moving across the landscape." Confusing statement. Resequence recommended. Consider using "moving across the landscape, as viewed by an observer."
- Pg 7-9, Night Landing Challenges, This topic departs from "Physiological Factors" and becomes operational in nature. Consider placing this in a different chapter.
- Pg 7-12, Turning or Banking; In the sentence, "On the right wing . . . " the pronoun "it" can be confusing to some readers. Consider replacing the word "it" with "the wing."
- Chapter 8, Transporting & Assembling the Aircraft & Preflight Procedures, Transporting the UAS, pp 7-10. Please add a reference to the danger of transporting Li-Po batteries. Something like, “Li-Po batteries pose an additional risk when being transported, especially if the Li-Po battery has been damaged in a sUAS crash. Li-Pos should always be transported in a fire-resistant container.”
- Pg 8-3, 3rd para, 3rd line – should be “fuel to oil”
- Pg 9-1, "Aviation Routine Weather Report (METAR)" is not correct; The METAR acronym stands for "Meteorological Aerodrome Report."
- Pg 9-2, Zulu time, "Zulu time (UTC) as opposed to local time." This section needs a discussion on how to convert Zulu time (UTC) to local time for application by the rPIC.
- Ch 11, Good ideas here, but some confusion in reading this chapter. Numerous models are referenced, but not all are fully explained. The chapter ends abruptly, without a summary. The figures are not sequenced properly with the text. Perhaps limiting the models and referencing others in "additional readings" or an appendix would improve the chapter.
- Pg 11-1, Steps for good decision-making, Material that follows this list does not follow this outline. Set up the follow-on paragraphs to follow this outline, or reorder the outline to follow the paragraphs below.

- Pg 11-1, Risk Management, Confusing sequence. Direct and Indirect experience should be explained after the risk management model presented in 11-1.
- Pg 11-2, Risk Management, Seat belt example sequence confusing. This example should follow the Risk Management Model and Figure 11-1.
- Pg 11-3, Risk Assessment, Wrong word choice. Bullet states "When larger aircraft system with a crew." Either change the adverb, when, or add a verb, such as operated, to the second two bullets.
- Pg 11-4, Risk Assessment, Inconsistent tense. keep the tense consistent throughout the story.
- Pg 11-4, Fig 11-3, Risk Assessment, Sequence confusing. Put the graphic below the initial reference to it.
- Pg 11-5, IMSAFE Checklist, It states "The pilot will need to ask, “Am I ready for this flight?” in terms of experience, recency, currency, physical, and emotional condition. The IMSAFE checklist provides the answers." IMSAFE does not address experience, recency or currency. Consider qualifying this statement.
- Pg 11-5, Weather, It states "As pilots evaluate the weather for a particular flight, they should consider the following:" If the bullets following this are meant to be an imcomplete list, specify that it is a partial list. Otherwise include items to complete the list. Consider adding wind, precip, and other items to list.
- Pg 11-5, External Pressures, It states "External pressures are influences external to the flight that create a sense of pressure to complete a flight—often at the expense of safety. Factors that can be external pressures include the following:" Definition appears to be incorrect. What is described seems more like internal pressures. See articles on this topic in Psychology Today, Mayo Clinic, etc.. FAA addresses external pressures in their published data as logistical matters that can be mitigated through contingency planning. Correct the definition. See associated comment.
- Pg 11-5, 11-6, The organization within the chapter/section is little awkward. PAVE is first explained in the "Mitigating Risk" section prior to the "decision making" section where it is referenced as a decision making model. Consider reorganizing.
- Pg 11-6, the decision-making process; One of the decision making models referenced is never expanded (5P). Expand upon it or leave it out.
- Pg 11-6, Certain Situations, It states "Human factors involves gathering research specific to certain situations (i.e., flight, maintenance, stress levels, knowledge) about human abilities, limitations, and other characteristics and applying it to tool design, machines, systems, tasks, jobs, and environments to produce safe, comfortable, and effective human use." The list includes stress levels and knowledge. These are not examples of situations. Change the list to specify only situations or re-write the sentence to describe a broader idea.
- Pg 11-6, Interaction, It states "The entire aviation community benefits greatly from human factors research and development as it helps better understand how humans can most safely and efficiently perform their jobs and improve the tools and systems in which they interact." - "in which" seems incorrect. Use "with which"
- Pg 11-6, Checklists, Process steps using the CARE and TEAM checklists are mentioned but never applied to the 3P model in sufficient detal to communicate the concept. Examples or additional details should be provided in this section if these are mentioned in the text here.
- Pg 11-7, Figure 11-5 – this is a real world example for manned aircraft. This would be much more relevant with a rPIC example. This example is for a C182 on a cross country flight. It should be changed to apply to UAS operation.

- Pg 11-8, Fig 11-6, DECIDE Model, Examples A and B do not follow the DECIDE acronym, e.g., Detect, estimate, etc. This needs clarification.
- Pg 11-9, Workload Management, It states "When a work overload situation exists, a pilot needs to stop, think, slow down, and prioritize. It is important to understand how to decrease workload." Confusing sequence. The last two sentences should be reversed.
- Pg 11-9, Situational Awareness and Workload are barely addressed. Expand on these.
- Pg 11-9, Figure 11-7 addressing operational pitfalls listed under Stress Management and Use of Resources seems a bit sparse and out of place. Consider expanding and placement.
- Pg 12-1, Contingency for an In-flight Emergency; The section assumes an engine failure that is communicated to the tower. In their words: "the price calls 'engine failure' just as it quits running"… then in the last paragraph states "The alert allows the tower to clear airspace for the emergency." This scenario is assuming way too much. Assuming there is an engine failure close enough to a runway while still being able to clear traffic seems unrealistic. Suggest re-writing the scenario to be more realistic.
- Pg 12-1, In-flight emergency, It states "For those small UAs that do not have a manufacturer checklist, the remote should develop a checklist that will provide enough information that the aircraft will be operated in a safe condition." Missing word. insert missing word, the remote "pilot"...
- Pg 12-1, contingency for inflight emergency, It states "The Internal Pilot (IP) is in communication with the tower." Who/what is the Internal Pilot (IP)? This is confusing. Is there a pilot on board the UA? Clarify for reader.
- Pg 12-1, Contingency for an accident; While this section states that there are provisions for reporting under 14 CFR part 107 section 107.9, it fails to mention that there are also reporting requirements according to 49 CFR part 830.
- Need to amend this section in accordance with the reporting requirements in 49 CFR part 830.5. These include any persons suffering death or serious injury. Serious injury is defined in 49 CFR part 830.2 as: "Serious injury means any injury which: (1) Requires hospitalization for more than 48 hours, commencing within 7 days from the date of the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, muscle, or tendon damage; (4) involves any internal organ; or (5) involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface."

  Additionally consideration should also be given to the following reporting requirements under 49 CFR part 830.5 as outlined in the NTSB Advisory to Drone operators:

  Operators must consider that the rest of the reporting requirements for serious incidents listed in section 830.5 apply regardless of UAS weight. Listed serious incidents that apply to all UAS include the following events:

  - Flight control system malfunction or failure: For an unmanned aircraft, a true “fly-away” would qualify. A lost link that behaves as expected does not qualify.
  - Inability of any required flight crewmember to perform normal flight duties as a result of injury or illness. Examples of required flight crewmembers include the pilot, remote pilot; or visual observer if required by regulation. This does not include an optional payload operator.
  - Inflight fire, which is expected to be generally associated with batteries.
  - Aircraft collision in flight.
  - More than $25,000 in damage to objects other than the aircraft.

  - Release of all or a portion of a propeller blade from an aircraft, excluding release caused solely by ground contact.
  - Damage to helicopter tail or main rotor blades, including ground damage, that requires major repair or replacement of the blade(s).
  - An aircraft is overdue and is believed to have been involved in an accident.

- Pg 12-1, Contingency for an accident; Last paragraph in this section states: "Often when people respond to a crash, everyone wants to determine the cause of the crash." It should be noted that for any accident/incident that falls under the reporting requirements of 830.5, the NTSB has sole authority to determine the cause of an accident. Suggest including a statement that clarifies that under 49 part 800.3: "The Board is responsible for the investigation, determination of facts, conditions, and circumstances and the cause or probable cause or causes of: all accidents involving civil aircraft, and certain public aircraft" (public aircraft are police, fire fighting etc.)
NTSB has sole authority to determine cause of accidents. This needs to be made clear in this paragraph.
- Ch 13, Flight Service Stations; Lacks information on the acceptable use of FSS services by rPICs. Add section describing rPIC use or limitations regarding use of FSS. Also, if allowable, indicate that FSS is a source available to rPICs for information on SUA hot/cold status.
- Pg 13-1, Class B Airspace, It is stated "a remote pilot must receive authorization from ATC before operating in Class B airspace." UAS operators do not receive approval from ATC to operate in Class B airspace. The approval is through LAANC and ATC is notified of the UAS operation. Recommend correcting this to indicate the apporoval process is through LAANC for Part 107 aircraft.
- Pg 13-2, Class C, Class C can underlie Class B; Add to second sentence in first paragraph: "Class C airspace can also exist underneath Class B airspace; for example at Chicago Midway airport."
- Pg 13-2, Class D, It is stated "Think of Class D as controlled airspace." Class D IS controlled airspace and the sentence implies coordination is not necessary in Class D airspace. Revise sentence to clarify Class D IS controlled airspace.
- Pg 13-2, Class D, Authorization to operate in Class D airspace is through LAANC. ATC is only notified after the FAA has approved the operation. Add the requirements for UAS approval under Part 107 (LAANC) for acces to Class D airspace.
- Pg 13-3, Class E, First paragraph states "For the rPIC, there is really not a difference. However, for manned aircraft pilots, controlled and uncontrolled airspace have different visibility and cloud clearance requirements." Recommend removing this sentence or clarify the differences. If there are no differences for UAS standards in controlled and uncontrolled airspace then state the requirements in each airspace section.
- Pg 13-3, SOA airspace. There's no formal definition in the PCG for SAO. The term Special Activity Airspace (SAA) defines airspace not considered SUA. Revise sentence for consistency.
- Pg 13-4, Restricted Areas, Material describes ATC handling of Restricted Airspace, but does not describe the rPIC requirements. Clarify rPIC responsibilities for Restricted Areas. Add fourth paragraph: "The rPIC is responsible for determining whether a restricted area is active. This can be determined by consulting Sectional Aeronautical, VFR Terminal Area, appropriate En Route charts, and NOTAMs for the Controlling Agency/Contact Facility"
- Pg 13-4, Warning Areas. Describe rPIC responsibilities for Warning Areas. Add second paragraph: "The rPIC is responsible for determing whether a warning area is active. This can be determined by

consulting Sectional Aeronautical, VFR Terminal Area, appropriate En Route charts, and NOTAMs for the Controlling Agency/Contact Facility"

- Pg 13-4, MOAs, Describe rPIC responsibilities for MOAs. Add sentence: "The rPIC is responsible for determining whether a MOA is active, and to exercise extreme caution if operating in an active MOA." (language copied in part from AIM 3-4-5.c)
- Pg 13-4, Controlled Flight Areas; More of a question: given that some sUAS are very small, and therefore will be difficult for CFA observers to see, what guidance is appropriate for rPIC, especially as there does not appear to be an easy way for rPICs to know where CFAs are located? Add guidance for rPICs for Controlled Firing Areas.
- Pg 13-5, LAA, Local Airspace Advisories are not SUA or SAA. Remove from airspace section and place in an appropriate section such as NOTAMs or ASOS.
- Pg 13-5, MTRs, Given that some MTRs are intended for traversal at high speed/low altitudes (i.e. below 1500' AGL), provide guidance to rPICs. Suggest: "Since some MTRs may be flown by military aircraft at high speeds and low altitudes, rPICs should avoid (or stronger language) flying in the vicinity of MTRs."
- Pg 13-9, Max Elevation Figures, The description in here is more useful for manned aviation. Rewrite to be more useful for unmanned aviation. Suggest including the following points:
  - MEFs are primarily intended for manned aviation, to ensure terrain and obstacle clearance in Part 91. They are referenced to sea level.
  - MEFs can be of interest to rPICs as indicators of highest terrain or obstacle in the square, but rPICs must follow maximum altitude requirements as defined by Part 107.
- Pg 13-9, Roads / Railroads / Power Lines / Lakes. Add sentence to each describing that these are useful to help pilots orient themselves to airspace. "These features are included to assist pilots in orienting themselves to charted airspace"
- Pg 13-10, Variation. Add sentence to explain that manned aviation and therefore charting typically uses directions referenced to Magnetic North rather than True North. Add sentence to beginning of section: "Manned aviation in most cases uses directions referenced to Magnetic North rather than True North. Historically, this is because aircraft have carried magnetic compasses as their basic direction reference, and still carry them as a backup in case of GPS failure. Therefore, directions as depicted on charts are referenced to Magnetic North."
- Pg 13-11, P/C Glossary, The Pilot Controller Glossary is a separate publication and not part of the AIM. Revise second sentence under Understanding Proper Radio Procedures: "A review of the Pilot/Controller Glossary assists a pilot in…"
- Pg 13-11, PCG, It is stated "A review of the Pilot/Controller Glossary contained in the AIM assists a pilot in understanding standard radio terminology." The PCG only provides common definitions to the terminology used throughout the AIM. Revise sentence to indicate the PCG provides definitions for termonology used throughout the AIM and clarify phraseology is found throughout the AIM chapters.
- Pg 13-12, rPIC requirements / expectations w.r.t. ATC communications. In "Recommended Traffic Advisory Procedures": Describe more explicitly what ATC radio communications equipment an rPIC is required to have in various circumstances (e.g. none? VHF receiver only? VHF Transceiver? Under what conditions?) Add necessary information. Suggest adding something along the lines of the following for example (corrected to be accurate): "rPICs are required to have an aviation communications VHF receiver to monitor pilot communications when operating in the vicinity of airports, the associated arrival and departure paths, and the airport traffic pattern. rPICs should use information received from

pilot communications to adjust their activities to give way to manned aviation activities at all times. rPICs are prohibited from making transmissions on VHF frequencies."