AC 20-24C, Approval of Propulsion Fuels and Lubricating Oils

Comments and Other Revisions

CONTENTS

INTRODUCTION

AC 20-24C cancels AC 20-24B and describes established methods of adding fuels and oils as engine, aircraft, or APU operating limitations. These established methods reflect procedures and practices employed by the Engine and Propeller Directorate (EPD) for oversight of successful aviation fuel and lubricating oil certification projects conducted over many years. These procedures and practices have essentially relied on fuels and oils grade or brand designations that were identified by industry voluntary consensus-based, military, or other governmental standards.

A draft of this AC was made available for public comment on September 1, 2010, for a period of 60 days. The FAA received many comments regarding the use of other, new and novel methods to add fuels and oils as engine, aircraft, or APU operating limitations in lieu of the methods described in the AC. However, the EPD cannot develop guidance describing other, new and novel methods until we gain sufficient certification oversight experience with these projects. Therefore, the final AC does not contain guidance on these new and novel methods to add fuels and oils as engine, aircraft, or APU operating limitations.

Disposition of Public Comments on Draft AC 20-24C, Approval of Propulsion Fuels and Lubricating Oils

	Page & Para	Comment:	Disposition
1	General	Nice piece of work	Agreed
2	Para. 6.a.(2)	Should include DEF STAN 91-87 and CGSB 3.24 (JP-8 with FSII, NATO F-34 and F-37)	Agreed in part. Section 6.2 is not all inclusive, it only provides some examples of international specs. CGSB specs are noted but not DEF STAN 91-87. See 8.a.(3) of issued AC.
3	6.b.(3)(b)	Add note stating that ASTM D7566 applies only at point of manufacture or batch origination	Disagree. This is covered in specification and is not relevant to engine/aircraft operating limitation approval.
4	6.c.5(f)	Paragraph lists too many different technical items. Should be separated by technical subject.	Agree. The paragraph is divided into four subparagraphs (see 8.c.9(f) of issued AC.,.
5	General	Accurate description of jet fuel approval process.	Agreed.
6	2.a	Applicability draws “additives” into the scope of AC, but additives not covered in guidance	Agree in part. “Additives” removed from applicability. Additive approvals to be addressed in follow-on guidance.
7	7.b.(3)(b)	Description of SAE turbine engine oil formulation change process not correct	Agreed. Reworded in response to comment (see paragraph 9.b.(3)(b)1 and 2).
8	6.b.3.(b)1	Reword to: “Once a “Drop-In Fuel” has been qualified by the manufacturer per D4054 to Standard Specification D7566, and enters the fuel distribution system, it is designated as D1655; i.e., Jet A or Jet A-1. At that time the fuel is designated as a revision to the existing D1655 aviation fuel specification, and the qualification process is transparent to TC and STC holders, and aircraft end users and maintainers.”	Agree in part. Revised wording to reflect intent of comment .
9	6.b.3.(b)	Clarification is needed that qualification and test procedures in place with the ASTMs, together with the test programs that must be performed on “Drop-In Fuels”, are sufficient to guarantee the suitability of these fuels with airframe fuel systems once designated as D1655 Jet A or Jet A-1.	Agree in part. Revised wording to reflect intent of comment (see paragraph 8.b.(3)(b)) .
10	6.b.3.(b)2	Clarification is needed that aircraft TC and STC certification limitations do not change. If an aircraft is certified to use ASTM D1655 fuels, it will continue to be so certified. At the point of the end user, there is only D1655 Jet A or A-1, not "bio fuel", "synthetic fuel", or "conventional fuel".	Agree. Added subparagraph 8.b.4.(b)4 to incorporate intent of comment.

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11	General	There is not any mention of AC 27-1 or 29-2	Agreed in part. However, it was not necessary to refer to these ACs so they are not referenced.
12	6.b.3.(b)	There is not any mention of Jet B fuel (ASTM D6615) replacement approvals.	Agree in part. 6.b.3.(b) is intended to address "drop-in" jet fuels in general, so it would apply to Jet B. However, the D7566 Jet A drop-in example is used because this is the most prominent example of a drop-in fuel. Note that the Jet B spec, D6615, is listed in the section 5.b. of issued AC.
13	6.c.(4)	Doesn't include the 500 hour flight test that was listed as an option in AC 20-24B to the 150 hour 33.49 endurance test.	Agree in part. This test may be proposed as an Equivalent Level of Safety (ELOS) provision. So, it is still possible to perform the 500 hour flight test in lieu of the 33.49 150 hour endurance test if approved as part of a specific project's compliance plan.
14	6.a.(2)(c)	There is also a Russian Jet A-1 spec, GOST R 52050, "Aviation Turbine Fuel Jet A-1, Specifications".	Disagree. It is not necessary to add this spec reference because this section provides the most common examples of international fuel specifications, but is not intended to be an all-inclusive listing.
15	6.a.(3)	There are also Russian and Chinese Avgas specs: GOST 1012-72 "Aviation petrols - Specifications" and Chinese GB/T1787-79(88)	Agree. See paragraphs 8.a.(4) (e) and (f).
16	6.c.(4)(d) 6.c.(4)(e) 7.a.(2) 7.b.(3)(a)	Add "spark ignition".	Agree. See 8.c.(8)(d), 8.c.(8)(e), 9.a.(3), and 9.b.(3)(a) of issued AC.
17	Appdx 1, 1.	What about Superior Air Parts Engines?	Disagree. This appendix describes a procedure developed for use with SAE aero standard J1899 which only addresses Lycoming Engines and Teledyne Continental Motors engines.
18	6.a.(2)	Add military JP-4 and JP-5 fuels.	Agree (see 8.a.(2)(b) of issued AC).
19	7.a.(1)	Remove "military" from former users of MIL-PRF-23699 oil. Also, correct designation from "STD" to "PRF".	Agree (see 9.a.(1) of issued AC.
20	7.a.(1)	Add MIL-PRF-7808 and additional description of where to find DOD specs and of interchangeability of DOD oils.	Disagree. This AC is directed at commercial approvals only.
21	7.a.(2)	Delete turbine.	Agree. See 9.a.(3) of issued AC.
22	7.a.(2)	Replace MILSTD with MILSPEC	Agree. See 9.a.(3) of issued AC.
23	7.a.(2)	Description of where to find DOD specs and of	Disagree. DOD policy is not relevant to this AC.

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		DOD permitted interchangeability of SAE oils.	
24	2.b	Statement that "FAA is not bound by AC and may require additional substantiation" defeats the purpose of the AC and creates uncertainty in the certification process.	Disagree. This AC provides an acceptable method of compliance to the airworthiness regulations guidance based on currently available knowledge and past experience. However, this AC is not a regulation and each certification project has different type design features. Therefore, if the agency finds an applicant's compliance plan for the particular type design does not provide an adequate means of compliance to the regulations when using this AC, the applicant will need to adjust their compliance demonstration(s) accordingly. This is a fundamental distinction between FAA regulations and FAA guidance and is therefore included as standard language in all ACs.
25	General	This AC represents "rulemaking by policy".	Disagree. This AC provides one acceptable method of compliance for adding a fuel or oil operating limitation to an existing TC, but neither mandates that this method be used nor that it is the only method that can be used. This AC also does not add any additional regulatory requirements. Like AC 20-24B, AC 20-24C describes a compliance method based on the submittal of a fuel or oil specification with acceptable controls, and on compliance with all of the applicable regulations (such as CFR14 Part 33).
26	4.c	Improper reference and use of OMB circular no. A-119.	Agreed. Reference removed (see 5.c. of issued AC.
27	General	Requirement to seek consensus among a voluntary industry group (such as ASTM) composed of competitor and conflicting interests will stifle innovation and development.	Disagree. This AC provides one acceptable method of compliance based on ASTM specifications, but neither mandates that this method be used nor that it is the only method that can be used. In addition, our recent ASTM experience is contrary to the comment. ASTM has taken an international leadership role by issuing several new aviation fuel specifications and standards such as D7566 (synthetic jet fuels), D4054 (new fuel approval process), D6277 (82UL avgas), D7547 (UL91 avgas), and D7592 (UL94 avgas).
28	5.b	Historical precedent for using ASTM/SAE standards for operating limitations is not correct because AC 20-24B does not specify ASTM/SAE specs.	Disagree. The historical precedent is based on the fact that virtually all type certificated engine and aircraft rely on ASTM and SAE specs for designation of fuel and oil operating limitations. To argue against this historical

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			precedence, the commenters submitted a mere two examples of certification approvals that did not rely on an ASTM or SAE spec, but neither of those certification projects was conducted in accordance with FAA procedures. One commenter cited the November 22, 1999 FAA memo as supporting this departure from past precedent, but that misrepresents the content of that memo because it was written precisely to direct the use of the compliance method, or equivalent, described in this AC. All other STC approvals for aviation fuels such as ethanol and autogas relied on ASTM specifications for their operating limitations.
29	6.b.(2)	The AC requires the use of ASTM or SAE specs and only provides guidance for approval of operating limitations based on ASTM or SAE specs, but the previous AC 20-24B provided more guidance for use of other types of specs.	Disagree. This AC is not a requirement to use the ASTM or SAE process. AC 20-24B does not provide any guidance regarding "approval of fuel or oil specifications", but rather states that an acceptable fuel or oil specification is required before proceeding with the certification project. This is the same process described in this (AC 20-24C) version.
30	6.c.(1)	The AC creates a regulation to require an applicant to first present a spec from a third party. The applicant has the right to define his/her own fuel/oil spec and demonstrate that the spec is sufficient to establish conformity for testing and demonstrating compliance.	Disagree. This AC is not a requirement to use the ASTM or SAE process. It is an acceptable method of compliance, but not the only acceptable method of compliance. The Part 33 regulations do not cover evaluation of an aviation fuel specification, but rather the evaluation of an engine when operating on a specified fuel. So, the fuel must be defined in an acceptable manner prior to conducting the Part 33 compliance program. Also, the existing regulation applicable to aviation fuel and oil specifications, sections 33.7(b)(2) and (3), and (c)(2) and (3), requires the FAA to establish operating limitations based on data submitted for the Part 33 compliance program, and the FAA makes the determination whether that operating limitation is acceptable. Therefore, the applicant has the right to propose his/her own fuel/oil spec as an operating limitation, but it must be found acceptable by the FAA in accordance with the existing regulation. Paragraph 2.c. was added to the issued AC to emphasize that applicants may propose to use other types of specifications.

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31	6.c.(4)(b)	The long duration engine testing described in this section imposes testing requirements beyond the regulatory requirements of Part 33.	Agree in part. Section 33.19 requires the applicant to substantiate that the engine design and construction will minimize the development of an unsafe condition between overhaul periods. This can be accomplished by specifying an initial "new engine" TBO that can be supported by only performing the block testing as specified in Part 33, or by performing long duration engine testing beyond the block testing to substantiate a longer TBO such as the TBO of an existing, mature engine. The section was reworded to better reflect these regulatory requirements (see 8.c.(8)(b) and 9.d.(1) of issued AC).
32	General	This AC outsources FAA fuel specification approval responsibilities to a private organization and does not require FAA participation in spec approval process.	Disagree. The FAA has never had regulatory authority to approve fuel specifications, but is authorized by section 33.7(b)(2) to approve aviation fuel operating limitations for designated engines. Both AC 20-24B and AC 20-24C are consistent with this regulatory authority by stating that an acceptable fuel specification is required before proceeding with the certification project. Development, review, approval and issuance of fuel specifications has historically been accomplished by industry or government specification-writing organizations such as ASTM. The FAA participates in the ASTM aviation fuel subcommittee as a voting member and plays a key and vital role in the development and issuance of these specifications.
33	General	The FAA process to issue AC 20-24C should be stopped and the FAA should continue to use AC 20-24B.	Disagree. The recent increase in new and alternative aviation fuel development efforts necessitates clarification and updating of our existing guidance.
34	General	The FAA shouldn't require the use of an ASTM spec because ASTM doesn't accommodate trade secrets or proprietary information.	Disagree. This AC provides one acceptable method of compliance based on ASTM specifications, but neither mandates that this method be used nor that it is the only method that can be used. Additionally, ASTM has specific procedures to accommodate the use of patented materials or processes in their specifications and these procedures have been successfully applied in their specifications.

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35	General	This AC will not help advance the approval and deployment of an unleaded aviation gasoline.	Disagree. The purpose of this AC is neither to advance nor impede the development or deployment of an unleaded aviation gasoline, but rather to facilitate the aviation fuel approval process by clarifying and describing an acceptable method of compliance to existing FAA regulations.
36	General	The ASTM process is too slow to respond to the factors that demand new and alternative fuels.	Disagree. Additionally, it is not within the FAA's regulatory authority to oversee the pace of ASTM specification issuance. However, the FAA played a key leadership role in the development and issuance of a new synthetic jet fuel spec in a relatively short 14 month period. ASTM has issued several other new aviation fuel specifications and standards in similar timeframes such as D4054 (new fuel approval process), D7547 (UL91 avgas), and D7592 (UL94 avgas). The commenters are encouraged to participate in the ASTM aviation fuel subcommittee to gain a thorough and complete understanding of the process utilized by ASTM and of the recent successful results of this process.
37	General	The FAA should take a strong leadership role to develop and approve a new unleaded aviation gasoline.	Agree. Issuance of this AC will facilitate the aviation fuel approval process by clarifying and describing an acceptable method of compliance to existing FAA regulations. This will ensure any fuel that is approved will have been evaluated to the extent necessary to perform in a safe and consistent manner when introduced in service. In addition, the FAA has funded an extensive amount of research of unleaded avgas and the FAA Technical Center is recognized as the industry leader for evaluation of candidate aviation gasolines. And finally, the FAA has established the Unleaded Avgas Transition Aviation Rulemaking Committee (UAT ARC) to work with industry to develop a recommended plan to address this issue.
38	General	Small businesses need clear steps to proceed.	Agreed. Issuance of this AC will facilitate the aviation fuel approval process by clarifying and describing an acceptable method of compliance to existing FAA regulations.

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39	General	Request to extend comment period.	Agreed. All requests to extend comment period were approved. However, further extension is unnecessary because the extended comment period was sufficient to seek and obtain public input into the content of our advisory material.
40	General	Thank you for extending comment period.	Agreed.
41	General	AC 20-24B did not require industry-wide consensus based standards prior to certification and allow direct FAA approval via STC.	Disagree. AC 20-24B did not allow for direct approval of a fuel specification via STC. Both AC 20-24B and AC 20-24C allow for approval of aviation fuel operating limitations via STC, but not direct approval of fuel specifications. In addition, paragraph 5.d of AC 20-24B required that the fuel to be tested during the certification project be covered by a specification that is written in sufficient detail to provide, at minimum, the physical properties and limits by which uniform quality and composition can be maintained. Historically, this requirement has been met by use of an ASTM or SAE spec.
42	General	The FAA should be streamlining the aviation fuel approval process.	Disagree. The FAA is facilitating the aviation fuel approval process by clarifying and describing an acceptable method of compliance to existing FAA regulations. This will ensure any fuel that is approved will have been evaluated to the extent necessary to perform in a safe and consistent manner when introduced in service. The FAA will not bypass or shortcut regulatory requirements that promote safety to streamline approval of aviation fuel.
43	General	Public notice of draft AC was insufficient and didn't meet legal standards for public notice.	Disagree. AC's are not general rule making and therefore not subject to the public notification requirements of the Administrative Procedures Act. In addition, the extended comment period was sufficient to seek and obtain public input into the content of our advisory material.

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44	General	No statement in AC regarding FAA's intent to withdraw AC 20-24B. If AC 20-24B to be withdrawn, then comment period should be extended.	Agree in part. While no such statement of intent to withdraw an earlier version of guidance material is required by regulation, we changed the AC to indicate that AC 20-24B has been cancelled (see paragraph 3. of the issued AC). Given that publishing an AC is not general rule making, and that we have had the benefit of public input into the development of this AC, reopening the comment period is not required.
45	4.a	References section should include AC 20-24B	Disagree. AC 24-24B has been cancelled, and 24C reflects the advances that 25 years of experience has provided. AC 24B is outdated, no longer effective guidance, and therefore, it has been cancelled and is not referenced.
46	6.c.(4)(e)	Test instrumentation is not normally approved by the FAA, so requirement for approval of detonation measurement system should be removed.	Agree in part. However, the FAA does approve "methods" to measure detonation as integral elements of test plans. Therefore this section has been reworded to state that the detonation measurement method must be approved by the FAA (see paragraph 8.c.(8)(e) of issued AC).
47	7.d.(2)	14 CFR 33.19 does not have a durability testing requirement.	Agree in part. Section 33.19 requires the applicant to substantiate that the engine design and construction will minimize the development of an unsafe condition between overhaul periods. Additionally, section 33.15 requires that the durability of materials be be established on the basis of experience or tests. Compliance with these requirements can be accomplished by either extended testing or by analysis showing the block testing substantiates the proposed TBO when operating with the new oil. The section will be reworded to better reflect these regulatory requirements (see paragraph 8.c.(8)(b) and 9.d.(1) of the issued AC.
48	Appdx 1, 3 and a.(6)	"Limited STC" not defined and there is no regulatory basis for a "limited STC".	Agreed. We reworded Appendix 1 to remove references to "limited STCs".
49	Appdx 1, 3.b	SAE J1899 flight testing is not traceable to Part 33, therefore it is an example of rulemaking by AC.	Disagree. Appendix 1 of this AC is not a requirement to use the SAE J1899 qualification process. It is an acceptable method of compliance, but not the only acceptable method of compliance. It provides guidance if an applicant wishes to obtain CFR14 Part 33 approval to operate with an engine oil concurrently with qualification of that oil to SAE J1899.

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50	6.c.(4)(e)	The draft AC states that "detonation is a critical requirement", but this should be rewritten to reflect that "avoidance and acceptable margins of engine detonation are critical requirements"	Agreed. Reworded to reflect intent of comment (see paragraph 8.c.(8)(e) of issued AC)..
51	6.c.(5)(f)	Is it the FAA's intent to focus on the flammability of the fuel tank, or the contents of the fuel tank?	Agreed. Reworded to reflect intent of comment (see paragraph 8.c.(9)(f).
52	Appdx 1	The J1899 SAE specification which defines ashless dispersant aircraft piston engine lubricating oil should be extended to any and all engine manufacturers.	Agree in part. The engine oil qualification procedure in the current J1899 specification is limited to TCM and LE engines. The guidance in this AC reflects this current version and cannot be changed until J1899 is revised by the SAE committee.
53	Appdx 1, 3.b(1)	Appendix 1, paragraph 3.b.(1) states that 500 hour flight testing should be conducted on specified TCM & LE engines in addition to the 150 hour endurance testing where as the previous version of the advisory circular provides guidance for conducting 500 hour flight test in lieu of the endurance block test as defined in §33.49 and §33.87. If the FAA's intent is to increase the required testing for qualification of fuels, the requirements should be found in the regulations and not the advisory circular.	Disagree. Note that Appendix 1 only applies to oils, not fuels. Also note that this AC provides one acceptable method of compliance, but neither mandates that this method be used nor that it is the only method that can be used. The previous version of the AC states in section 5.d that the oil to be tested must be defined by a specification. This would require that the SAE qualification process be completed before initiating the Part 33 certification program, necessitating both a 150 hour engine test and 500 hour flight test before starting the Part 33 compliance program. An additional 150 hour endurance test could then be required for the Part 33 compliance. However, the guidance in Appendix 1 allows the SAE and FAA procedures to be accomplished concurrently, thereby actually reducing the amount of testing required to only the 150 hour and 500 hour tests.
54	Appdx 2	The content in Appendix 2 is provided to "aid the applicant in developing their compliance plans." but is "by no means all inclusive". It is recommended that an all inclusive list be provided or eliminating this section all together.	Disagree. This AC provides guidance based on currently available knowledge and past experience. However, it is not possible to anticipate all technical details of future certification projects, therefore an "all inclusive list" cannot be developed as it may not be appropriate for some future, unanticipated project.

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55	6.b.(2)	Section 6 b (2) should include non traditional fuel specifications in the parentheses at the end of the paragraph.	Disagree. This AC describes one acceptable method of compliance that is predicated on the use of industry, military or government specifications. Use of other types of specifications is not addressed in this method of compliance. However, paragraph 2.c. was added to the issued AC to emphasize that applicants may propose to use other types of specifications.
56	6.b.(3)(c) & (d)	Sections 6.b.(3)(c) and (d) both require the TC/STC holder to apply for an amendment each time the revision number of an automotive gasoline or Jet Fuel specification is changed. It is recognized that changes to the standards could affect the performance of the fuels in an aviation application but similarly to the aviation specific standards, the specification standard changes are usually minor. It is suggested that the AC provide a less burdensome method such as a report from the TC/STC holder to the E&PD as to the significance of the specification change and the expected need for an amendment.	Disagree. Because the cognizant ASTM subcommittee for out-of-scope specs does not evaluate spec changes for impact on aircraft and aircraft engines, this evaluation must be conducted under direct oversight by the FAA. Otherwise, the FAA could not accept the specification as an operating limitation.
57	6.c.(1)	Section 6.c.(1), commercial fuel specifications should be added to the list of specifications considered by the E&PD.	Disagree. Commercial specifications are included under "industry consensus-based" specs.
58	6.c.(4)(f)	Section 6.c.(4)(f), the paragraph states that "The test should include engine starting, acceleration,… under all approved conditions…" is a very extensive requirement. This should be changed to something like "Testing should include engine starting…. under those conditions that analysis of the fuel properties indicates a departure from previous experience with aviation fuels."	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.c.(8)(f).

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59	5.e and 6.c.(3)	This paragraph assumes that a new fuel or oil will be used in the airplane. It should be worded such that a new fuel or oil can be approved for engine use separate from airplane certification.. There may be instances where engine approved fuels or oils are not certified on the aircraft that uses the engine.	Agreed. Reworded to reflect the intent of the comment (see paragraph 7.f of the issued AC).
60	6.c.(5)	Viscosity is an important property for fuel system performance and should be considered.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.c.(9)(f)4).
61	6.c.(5)	Engine cooling requirements should be addressed under aircraft compliance plans.	Agreed. Engine cooling is addressed in 8.c.(9)(e) of the issued AC.
62	General	The commenters support the use of recognized industry standards for fuel and oil approvals. The FAA should continue to encourage the use of ASTM and SAE standards.	Agreed.
63	General	There is little benefit for this AC as written. The number of applicants for new fuels is not excessive, and a Generic Issue Paper for each Applicant may be more prudent. Then, the regulatory requirements the FAA feels are important could be applied and would avoid the conflict of rulemaking by AC (which is prevalent within this AC draft).	Disagree. The recent increase in new and alternative aviation fuel development efforts necessitates clarification of the FAA approval policy to support these many projects for both avgas and jet fuel. Regarding rulemaking by policy, this AC is not a requirement to use the ASTM process. It is an acceptable method of compliance, but not the only acceptable method of compliance.
64	General	If the FAA is going to rely on voluntary industry consensus standards for approval of new fuels or oils then specific definition of what industry consensus means is necessary. Otherwise, the term is too vague and interpretation will be left to individual FAA specialists, resulting in a lack of consistency. This is especially true when foreign industry standards are involved.	Agreed. Definitions added as Section 6 of the AC.
65	General	The AC does not include criteria for testing of mixed or blended fuel effects, i.e. mixing existing 100LL with a new 100UL, and the potential effects on engine/airframe or aircraft performance.	Agreed. New paragraphs added to reflect the intent of this comment (see paragraphs 8.c.(5) and 9.c.(3) of the issue AC).

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66	General	Nowhere in this AC is it stated that the criteria of 14 CFR Part 33 are inadequate to certify alternate fuels at the engine level, or 14 CFR Part 23/25 at the aircraft level. Most of what is contained in this draft AC would be captured in the cert/test plans. It is not necessary to have 29 pages of language to enforce having industry consensus or a standard/spec for new fuels to be value added. It is recommended that this instead be stated in an FAA policy letter.	Disagree. The recent increase in new and alternative aviation fuel development efforts necessitates clarification of the FAA approval policy to support these many projects for both avgas and jet fuel.
67	General	ASTM D4054-09 "Standard Practice for Qualification and Approval of New Aviation Turbine Fuels and Fuel Additives" provides comprehensive guidance for the fuel approval process, as does MIL-HDBK-510-1 "Aerospace Fuels Certification". AC 20-24B is mostly directed toward 14 CFR Part 33 approvals and does need updating to go along with the guidance added to the revision to D4054. AC 20-24C does not complement the work done on D4054-09 as was intended and doesn't go far enough to provide the fuel approval methodology; it gives a listing of regulations to consider that are suppose to be applicable to fuels approval without really offering much in the way of guidance or explanation as to why.	Disagree. The Part 33 regulations do not cover evaluation of an aviation fuel specification, but rather the evaluation of an engine when operating on a specified fuel. So, the fuel must be defined in an acceptable manner prior to conducting the Part 33 compliance program. Both AC 20-24B and AC 20-24C pick-up where ASTM leaves off. D4054 specifies how to approve a jet fuel, both ACs describe how to certify engines and aircraft after the fuel is approved (and a spec is issued). Consequently, neither AC provides guidance on how to approve a fuel, but do provide guidance on how to approve engines and airplanes when operating on a specified fuel.

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68	General	IATA(International Air Transport Association) 2008 Report on Alternative Fuels, Section 4.4 "Proposed Federal Aviation Administration Guidance For The Certification Of Fuels" described the guidance intended to be in the revision of AC 20-24B. It states that "The revision will be structured to provide guidance that will address existing, modified and new fuels, as well as existing and new engines and airplanes." The guidance and structure described in section 4.4 of that document would be very appropriate guidance to the applicants reading this AC.	Agree in part. The FAA believes that AC 20-24C accommodates all of the "scenarios" described in the IATA report. The FAA is constrained to some extent to only providing guidance on FAA elements of the fuel approval process, and cannot describe the industry elements.
69	3.	Why aren't the regulations in the Appendices listed if they are also applicable?	Agree in part. Section 3 only includes the regulations that are directly applicable to aviation fuel and oil operating limitations.
70	5.b	"Once shown, the Engine and Propeller Directorate (E&PD) issued the TC, amended TC, or STC with the fuel or oil identified as an operating limitation." This statement only applies to engine products, whereas earlier it was talking about engine, propeller and airplane products. Should this statement also refer to aircraft TCs approved by ACO.	Agreed. Reworded to reflect intent of comment (see paragraph 7.b. of the issued AC).
71	5.d.	"Applicants proposing a fuel or oil for a product should first…" Fuel additives should also be mentioned under this guidance.	Disagree. Additive approvals to be addressed in follow-on AC revision.
72	5.d	The language that the FAA requires "proof of approval" of a standard or specification for fuel before proceeding is rulemaking by AC and is not appropriate. Better language or approval methods/processes need to be added. This is precluding development of a fuel specification or standard that cannot proceed in parallel with engine/aircraft certification. This is not an expedient way of advancing science or technology.	Agree in part. This AC provides acceptable method(s) of compliance for a approval of a new aviation fuel or oil, but does not mandate that this method be utilized. Paragraph 2.c. was added to the issued AC to emphasize that applicants may propose to use other types of specifications. The AC provides guidance pertaining to compliance with existing regulations, and does not add any requirements beyond these existing regulations. However, the subject paragraphs (see paragraphs 7.e. and 8.c.(3)) have been revised to accommodate concurrent specification development and product certification.

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73	5.e	"… the new fuel or oil may be identified as an engine operating limitation in the airplane or rotorcraft TCDS and flight manuals." This is written as if the engine operation is the only limitation. It is not only an 'engine operating limitation' but may be an aircraft fuel system operating limitation as well.	Agreed. Reworded to reflect the intent of the comment (see paragraph 7.f. of the issued AC).
74	6.a.2(c)	RT (thermally stable) fuel is also covered by this specification.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.a.(3)(c) of the issued AC).
75	6.a.2(d)	Replace GB6537-94 with the latest revision: GB6537-2006.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.a.(3)(d) of the issued AC).
76	6.b.(1)	The aircraft 6.b.(1)(b) also establishes operating limitations independent of and not always the same as the engine limitations. They are listed in the AFM & aircraft TCDS. This paragraph is written about the engine.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.b.(1) of the issued AC).
77	6.b.(3)(b)	"ASTM, however, requires that new jet fuels or significant modifications of existing fuels be evaluated in accordance with standard D4054 to determine if the new fuel is suitable for aviation use." The guidance in the updated D4054 standard is now available for applicants to use but what requires it?	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.b.(3)(b)1 of the issued AC).
78	6.b.(3)(b)	MIL-HDBK-510-1 should also be cited for use to evaluate the suitability of candidate fuel's properties.	Agree in part. Reworded to reference MIL-HDBK-510-1 (see paragraph 8.b.(3)(b)1 of the issued AC).
79	6.b.(3)(b)	"Modifications such as the use of alternative feed stocks, for example, coal, natural gas, or biomass, are evaluated in accordance with D4054." This statement appears to state that D4054 is evaluating the feed stocks making up the fuel, rather than the fuel properties.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.b.(3)(b) of the issued AC).

	Page & Para	Comment:	Disposition
80	6.b.(3)(b)1	"D7566 and D1655 are cross-referenced to allow D7566 fuels to be redesignated as D1655 fuels when they enter the distribution system. Consequently, D7566 fuels are effectively equivalent to a revision to the existing D1655 aviation fuel specification." This is a confusing sentence. The reader does not know what is meant by the distribution system – a tank farm pipeline or fuel system plumbing. The following wording is suggested: 'ASTM D7566-09 specification includes the same standard requirements as ASTM D1655, with additional requirements to assure the alternative fuels meet the quality controls needed to assure compatibility with existing petroleum based products. The interrelationship between the D7566 and D1655 specifications is such that once a fuel passes the requirements of D7566 it is accepted as also meeting the requirements of D1655.'	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.b.(3)(b)2 of the issued AC).
81	6.c and 7.c	The title "Operating Limitations for Aviation Fuel: Certification Compliance Plans", this language is not consistent with the language on page 13 for Lubricating oils "Operating Limitations for Oil: Compliance Plans". Request that this be corrected.	Disagree. Wording reflects unique requirements of fuel or oil compliance plans..
82	6.c.(1)	"The Engine and Propeller Directorate (E&PD) is the FAA's technical focal point for identifying the applicable airworthiness certification requirements involving aviation fuel." E&PD may be the focal for the engine certification requirements but the aircraft certification office (ACO) is the focal for the aircraft regulatory requirements.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.c.(1) of issued AC).
83	6.c.(1)	"Applicable airworthiness requirements are those FAA regulatory standards for which the showing of compliance is contingent on fuel properties." This statement is ambiguous. If the applicable regulations are those cited in section 3.0 it should be stated as such.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.c.(1) of issued AC).

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	Page & Para	Comment:	Disposition
84	6.c.(1)	"Once applicants present the industry consensus-based, military, or governmental fuel grade, designation, or specification to the E&PD, the Directorate will aid applicants as they develop a compliance plan." The aircraft applicant should work with the ACO to develop a suitable compliance plan.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.c.(1) of issued AC).
85	6.c.(2)	"An applicant's compliance plan should address all applicable airworthiness certification standards, some of which are discussed below." This statement only discusses a few regulations. Request clarification on the other regulations presented in the Appendices.	Disagree. The AC is intended to provide guidance on key regulations only. Compliance with other regulations may be addressed in the project specific compliance plan.
86	6.c.(3)	"If a qualification project for a new operating limitation for fuel for an APU is required..." What is meant by this statement? Please provide clarification and examples of what a qualification project is.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.c.(6) and (7) of issued AC).
87	6.c.(4) & (5)	Provide more detailed definition of 'fuel projects' as well as further discussion on potential reasons for considering those regulations listed in Appendix 2.	Agreed. Reworded to reflect the intent of the comment (see paragraph 8.c.(8) and (9) of issued AC).
88	6.c.(4) & (5)	Also, the guidance provided in ASTM D4054 is much more comprehensive than the guidance given here. The fuel approval process is defined as well as fit for purpose properties that should be considered.	Disagree. D4054 is intended for a different purpose than this AC. D4054 provides procedures to evaluate an aviation jet fuel, (and is limited only to jet fuel) whereas this draft AC provides guidance to certify engines and aircraft after the fuel (either jet fuel or avgas) is approved (and a spec is issued). The Part 33 regulations do not cover evaluation of an aviation fuel specification, but rather the evaluation of an engine when operating on a specified fuel. So, the fuel must be defined in an acceptable manner prior to conducting the Part 33 compliance program. Both AC 20-24B and AC 20-24C pick-up where ASTM leaves off. Consequently, neither AC provides guidance on how to approve a fuel, but do provide guidance on how to approve engines and airplanes when operating on a specified fuel.

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	Page & Para	Comment:	Disposition
89	6.c.(4)(a)	D4054 covers fuel wetted material compatibility. It has an extensive list of materials and test procedures, etc. Therefore the use of similarity analysis would be appropriate to use with this extensive material database rather than retest.	Agree in part. The last sentence in this paragraph is intended to address the comment: "materials compatibility data that was generated during the ASTM fuel specification development may be used" (see paragraph 8.c.(8)(a) of issued AC). In addition, D4054 is limited to jet fuel and is not applicable to avgas.
90	6.c.(4)(e)	The accuracy for detonation instrumentation is part of the cert/test plan, and as such, the defined FAA processes for approval need to be followed. This concern is already addressed by existing FAA process. Detonation testing can be an FAA Specific Finding.	Agreed. Wording revised to reflect intent of comment (see paragraph 8.c.(8)(e) of issued AC).
91	6.c.(4)(c)	Reference comments for 6.c.(4)(a). Also, the use of similarity analysis may be used instead of testing with extensive database of material test data	Agree in part. Similarity analysis may be accepted by the FAA for compliance with regulations.
92	6.c.(5)(e)	"The fuels ability to perform safely in high temperature conditions..." The regulations listed have performance & operational envelope considerations but should not be associated with safety.	Agreed. Wording revised to reflect intent of comment (see paragraph 8.c.(9)(e) of issued AC).
93	6.c.(5)(e)	"Applicants should perform fuel system hot weather and engine cooling testing to evaluate the fuel's performance…" Testing may not be necessary for showing of compliance in all cases and analytic methods should also be listed as an appropriate means of compliance.	Agreed. Wording revised to reflect intent of comment (see paragraph 8.c.(9)(e) of issued AC).

	Page & Para	Comment:	Disposition
94	6.c.(5)(f)	"Applicants should show the fuel is compatible with the aircraft fuel system components and does not have any adverse effect on fuel system performance." The basic fuel approval process is not really described in this AC. Approval of alternate fuels or additives should basically consist of a fuel properties analysis per ASTM D4054; a review of the original compliance for the affected regulations and some sort of analysis or test to verify that the different fuels have no impact on the compliance.	Disagree. D4054 is intended for a different purpose that this draft AC. D4054 provides procedures to evaluate an aviation jet fuel, whereas this draft AC provides guidance to certify engines and aircraft after the fuel is approved (and a spec is issued). The Part 33 regulations do not cover evaluation of an aviation fuel specification, but rather the evaluation of an engine when operating on a specified fuel. So, the fuel must be defined in an acceptable manner prior to conducting the Part 33 compliance program. Both AC 20-24B and draft AC 20-24C pick-up where ASTM leaves off. Consequently, neither AC provides guidance on how to approve a fuel, but do provide guidance on how to approve engines and airplanes when operating on a specified fuel.
95	6.c.(5)(f)	The guidance provided in ASTM D4054 is much more comprehensive than the guidance given in this paragraph. The fuel approval process is defined as well as fit for purpose properties that should be considered. It discusses in detail, and gives acceptable limits for, the properties stated here. MIL-HDBK-510-1 provides even more worldwide survey data for these properties.	See item 94 above. Also, note that both these documents are limited to jet fuel and do not provide test procedures for avgas.
96	6.c.(5)(f)	"Consider the effect of additives on pumping and flow characteristics ..." These are the only properties to consider for additives. Additives can have their own properties and considerations that have general effects for fuel systems and materials (e.g. anti-static compatibilities).	Agree in part. Reference to additives removed from paragraph (see paragraph 8.c.(9)(f)3 of issued AC).
97	6.c.(5)(f), App 3 intro	Provide additional guidance, similar to that given under 6.c.(4), on how to show compliance with all of the listed regulations, not just a reminder to go consider those regulations.	Disagree. The AC is intended to provide guidance on key regulations only. Compliance with other regulations may be addressed in the project specific compliance plan.
98	App 3 Intro	"Applicants should, therefore, work with the E&PD and their respective ACOs to develop their individual compliance plans." Aircraft applicants work with the ACO to develop compliance plans and do not typically work with the E&PD.	Agreed. Wording revised to reflect intent of comment (see Appendix 3 and Appendix 2 introduction of issued AC). Wording also revised in paragraph 8.c.(2).

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	Page & Para	Comment:	Disposition
99	General	Revision C of AC 20-24 should supplement AC 20-24B to allow other types of specifications.	Disagree. This AC is not a requirement to use the ASTM process. It is an acceptable method of compliance, but not the only acceptable method of compliance. AC 20-24B does not provide any guidance regarding "approval of fuel or oil specifications", but rather states that an acceptable fuel or oil specification is required before proceeding with the certification project. This is exactly the same process described in this (AC 20-24C) version. In addition, the AC 20-24B method of compliance is consistent with the use of ASTM and SAE specs and it would be difficult to comply with using alternative means of fuel or oil definition.
100	General	If AC 20-24C will be replacing AC 20-24B, then the FAA should explain whether there have been any changes in requirements that render Revision B no longer applicable or whether there has been any experience by which revision B does not show compliance with the applicable regulations.	Disagree. The recent increase in new and alternative aviation fuel development efforts necessitates clarification and updating of our existing guidance. This AC neither reflects new regulatory requirements nor adds additional regulatory requirements. Like AC 20-24B, this AC 20-24C describes a compliance method based on the submittal of a fuel or oil specification with acceptable controls, and based on compliance with all of the applicable regulations (such as CFR14 Part 33).
101	General	There is no regulatory requirement that a fuel specification has to be a consensus spec for the purposes of establishing operating limitations for aviation fuel.	Agreed. This AC describes one acceptable method of compliance that is predicated on the use of industry, military or government specifications. Use of other types of specifications is not addressed in this method of compliance. Paragraph 2.c. was added to the issued AC to emphasize that applicants may propose to use other types of specifications.

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	Page & Para	Comment:	Disposition
102	General	FAA should work with industry to enhance AC 20-24B to address specifications other than ASTM or SAE specs.	Agree in part. Issuance of this AC will facilitate the aviation fuel approval process by clarifying and describing an acceptable method of compliance to existing FAA regulations. This will ensure any fuel that is approved will have been evaluated to the extent necessary to perform in a safe and consistent manner when introduced in service. In addition, the FAA has funded an extensive amount of research of unleaded avgas and the FAA Technical Center is recognized as the industry leader for evaluation of candidate aviation gasolines. And finally, the FAA has established the Unleaded Avgas Transition Aviation Rulemaking Committee (UAT ARC) to work with industry to develop a recommended plan to address this issue.
103	6.a.(3)	Add ASTM D 7547 "Standard Specification for Unleaded Aviation Gasoline" to referenced specs.	Agreed. Revised to reflect comment (see paragraph 5.b.(7)).
104	6.b.(3)(c)	In favor of the direction laid out by Section 6. b. (3) (c) for fuels being brought to market via STC. Reapplication for an STC every time a revision/reapproval takes place ensures that any aircraft operating on that fuel is being run on a safe fuel.	Agree in part. For clarification, this method of compliance requires amended STCs only for revisions to non-applicable fuel specifications, but not for revisions to in-scope fuel specifications. This comment is addressed with current wording of AC.
105	6.c.(4)(e)	Worst case detonation conditions should reflect the intended geographic locations for which the aircraft will be operated in.	Agreed. This should be reflected in the applicant's operating limitations.
106	General	Draft AC 20-24C is ambiguous and arbitrary	Disagree. The AC provides guidance pertaining to compliance with existing regulations, and does not add any requirements beyond these existing regulations. This draft AC describes the same method of compliance as AC 20-24B, but incorporates additional clarifications necessary for these new fuel projects.

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	Page & Para	Comment:	Disposition
107	General	Draft AC 20-24B is not as flexible as AC 20-24B.	Disagree. This draft AC describes the same method of compliance as AC 20-24B. Paragraph 5.d of AC 20-24B required that the fuel to be tested during the certification project be covered by a specification that is written in sufficient detail to provide, at minimum, the physical properties and limits by which uniform quality and composition can be maintained. Historically, this requirement has been met by use of an ASTM or SAE spec. While the AC 20-24B method of compliance didn't directly specify the use of ASTM and SAE specs it would be difficult to properly comply with using alternative means of fuel or oil definition.
108	6.b.(2)	Is any government fuel specification acceptable? The FAA should define the performance standards (like a TSO) to determine an acceptable fuel or oil specification, rather than an organization.	Agree in part. Reworded to indicate that other industry, military or governmental specs must provide acceptable control of fuel/oil performance and properties (similar to wording in AC 20-24B in section 5.d)(see paragraph 8.b.(2) and 8.b.(3)(e). The definition of performance standards for specifications is beyond the scope of this AC.
109	7.b.(2)	The fact that the FAA cites " oil formulation brand designations based on SAE standards" almost implies that an oil's particular brand would be sufficient.	Agree in part. The paragraph wording specifically states that brand designations that are based on SAE standards are acceptable. Brand designations that are not based on SAE standards are not addressed in this AC.
110	Appdx 1	Adopt the methodology of the Appendix 1 methodology for oil, or oil additive, specification approval.	Agree in part. The method described in Appendix 1 is currently limited to only TCM and Lycoming engines because those companies participate in the SAE process. It would be possible to apply this method to other manufacturers engines if they also participate in the SAE process.
111	General	There is no regulatory requirement contained within 14 CFR parts 23 or 25 that requires an "industry consensus-based, military, or governmental specification." The AC should place emphasis upon performance standards, rather than standards organizations.	Agree in part. This AC is not a regulatory requirement; it is an acceptable method of compliance. The FAA is not relying on an organization; the FAA is identifying a means to define an operating limitation that has been found to be acceptable based on FAA participation in the development of those specifications. Paragraph 2.c. was added to the issued AC to emphasize that applicants may propose to use other types of specifications.

Summary of Other FAA Revisions to Draft AC 20-24C, Approval of Propulsion Fuels and Lubricating Oils

ID	Paragraph	Summary of Revision	Explanation
F1	1.	Added “aircraft” and “APU”, deleted “propeller”	Purpose changed to be consistent with content of AC. AC addresses APUs and aircraft, but not propellers
F2	8.b.(2)	Replaced “and other industry consensus based, military, or governmental specifications” are acceptable at front of paragraph with statement at end with guidance for identification of these specs as operating limitations.	This paragraph addressed only the identification of aviation fuel operating limitations, and as such, it was not necessary to include an acceptability statement for these other specs in this paragraph. Acceptability statement already existed in paragraph 8.b.(3)(e).
F3	8.b.(3)(e)	Revised last sentence from “FAA determines adequacy of other governmental, military, or industry voluntary consensus-based standards”, to “applicant should present sufficient information that these specs provide and equivalent level of property, performance, and quality control”.	Replaces arbitrary standard of “FAA determines adequacy” to objective standard of “applicant provides sufficient information”.
F4	8.c.(8) 8.c.(9) 9.d 9.e	Added statement “The following is by no means exclusive, and is provided as a recommended starting point only. Applicants should, therefore, obtain from the E&PD, as the FAA’s fuel focal point, guidance on the regulations with which they will need to show compliance.”	To avoid misinterpretation of guidance as complete listing of compliance requirements.
F5	8.c.(8)(a) 8.c.(9)(c)	Added statement to materials compatibility testing guidance to include testing of used and unused seals.	Reflects certification experience that was not include in draft AC.
F6	9.b.(2)	Deleted “and other industry consensus based, military, or governmental specifications” are acceptable at front of paragraph as this was not necessary for guidance for identification of these specs as operating limitations.	Guidance for identification of lubricating oil operating limitations for other types of specs is provided in 9.b.(3)(c).
F7	9.b.(3)(c)	Revised last sentence from “FAA determines adequacy of other governmental, military, or industry voluntary consensus-based standards”, to “applicant should present sufficient information that these specs provide and equivalent level of property, performance, and quality control”.	Replaces arbitrary standard of “FAA determines adequacy” to objective standard of “applicant provides sufficient information”.