REVISIONS TO IFR ALTITUDES AND CHANGEOVER POINTS—Continued

[Amendment 494 effective date June 30, 2011]

From	To	MEA
*3500—MRA		
§ 95.6438 VOR Federal Airway V438		
IS AMENDED TO READ IN PART.		
#Grantsville, MD VOR/DME	*Flint, MD FIX	5300
*4300—MCA Flint, MD FIX, W BND		
#Grantsville DME Unusable Beyond 20NM, Below 6000		
Flint, MD FIX	Hagerstown, MD VOR	4000

From	To	MEA	MAA
§ 95.7001 Jet Routes			
§ 95.7079 Jet Route J79			
IS AMENDED TO READ IN PART.			
#Key west, FL VORTAC	Dolphin, FL VORTAC	18000	45000
#Key West R–037 Unusable			
§ 95.8003 VOR Federal Airway Changeover Points Airway Segment V157			

From	To	Changeover Points	
		Distance	From
IS AMENDED TO ADD CHANGEOVER POINT.			
Vance, SC VORTAC	Florence, SC VORTAC	21	Vance
V3			
IS AMENDED TO ADD CHANGEOVER POINT.			
Vance, SC VORTAC	Florence, SC VORTAC	21	Vance
V438			
IS AMENDED TO ADD CHANGEOVER POINT.			
Grantsville, MD VOR/DME	Hagerstown, MD VOR	39	Grantsville

[FR Doc. 2011–14043 Filed 6–7–11; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 417

[Docket No. FAA–2011–0181; Amdt. No. 417–2]

RIN 2120–AJ84

Launch Safety: Lightning Criteria for Expendable Launch Vehicles

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Direct final rule; request for comments.

SUMMARY: The FAA is amending its lightning commit criteria to account for new information about the risks of natural and triggered lightning. This action amends flight criteria for mitigating against naturally occurring lightning and lightning triggered by the flight of an expendable launch vehicle through or near an electrified environment in or near a cloud. These changes will increase launch availability and implement changes already adopted by the United States Air Force.

DATES: Effective July 25, 2011. Submit comments on or before July 8, 2011.

ADDRESSES: You may send comments identified by Docket Number FAA–2011–0181 using any of the following methods:

- *Federal eRulemaking Portal:* Go to *http://www.regulations.gov* and follow the instructions for sending your comments electronically.
- *Mail:* Send comments to Docket Operations, U.S. Department of Transportation, 1200 New Jersey Avenue, SE., West Building Ground Floor, Room W12–140, Washington, DC 20590.
- *Fax:* Fax comments to Docket Operations at 202–493–2251.
- *Hand Delivery:* Take comments to Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

For more information on the rulemaking process, see the **SUPPLEMENTARY INFORMATION** section of this document.

Privacy: We will post all comments we receive, without change, to *http://www.regulations.gov,* including any personal information you provide. Using the search function of our docket web site, anyone can find and read the comments received into any of our dockets, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). You may review DOT's complete Privacy Act Statement in the **Federal Register** published on April 11, 2000 (65 FR 19477–78) or you may visit *http://DocketsInfo.dot.gov.*

Docket: To read background documents or comments received, go to *http://www.regulations.gov* at any time or to Docket Operations in Room W12–140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE., Washington, DC, between 9 a.m. and

5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this rule contact Karen Shelton-Mur, Office of Commercial Space Transportation, AST–300, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone (202) 267–7985; facsimile (202) 267–5463, e-mail *Karen.Shelton-Mur@faa.gov.*

For legal questions concerning this rule contact Laura Montgomery, Senior Attorney for Commercial Space Transportation, Office of the Chief Counsel, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591; telephone (202) 267–3150; facsimile (202) 267–7971, e-mail *laura.montgomery@faa.gov.*

SUPPLEMENTARY INFORMATION:

Authority for This Rulemaking

The FAA's authority to issue rules on commercial space transportation safety is found in Title 49 of the United States Codes, section 322(a), which authorizes the Secretary of Transportation to carry out rulemakings. 51 U.S.C. subtitle V, chapter 509, 51 U.S.C. 50901–50923 (Chapter 509) governs the FAA's regulation of the safety of commercial space transportation. This rulemaking is promulgated under the authority of section 322(a).

Direct Final Rule Procedure

The FAA anticipates this regulation will not result in adverse or negative comment and therefore is issuing it as a direct final rulemaking. Because the changes to the lightning commit criteria will increase launch availability and are already implemented at Air Force launch ranges, the public interest is well served by this rulemaking.

Unless a written adverse or negative comment or a written notice of intent to submit an adverse or negative comment is received within the comment period, the regulations will become effective on the date specified above. After the close of the comment period, the FAA will publish a document in the **Federal Register** indicating that no adverse or negative comments were received and confirming the date on which the final rule will become effective. If the FAA does receive, within the comment period, an adverse or negative comment, or written notice of intent to submit such a comment, the FAA will withdraw the direct final rule by publication in the **Federal Register**, and a notice of proposed rulemaking may be published with a new comment period.

Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. The agency also invites comments relating to the economic, environmental, energy, or federalism impacts that might result from adopting the changes. The most helpful comments reference a specific portion of the proposal, explain the reason for any recommended change, and include supporting data. To ensure the docket does not contain duplicate comments, please send only one copy of written comments, or if you are filing comments electronically, please submit your comments only one time.

The FAA will file in the docket all comments we receive, as well as a report summarizing each substantive public contact with FAA personnel concerning this rulemaking. Before acting on this proposal, the FAA will consider all comments received on or before the closing date for comments. The agency will consider comments filed after the comment period has closed if possible without incurring expense or delay. The FAA may make changes in light of the comments received.

Proprietary or Confidential Business Information

Do not file in the docket information that you consider to be proprietary or confidential business information. Send or deliver this information directly to the person identified in the **FOR FURTHER INFORMATION CONTACT** section of this document. Mark the information that is considered proprietary or confidential. If the information is on a disk or CD–ROM, mark the outside of the disk or CD–ROM and also identify electronically within the disk or CD–ROM the specific information that is proprietary or confidential.

Under 14 CFR 11.35(b), when the FAA is aware of proprietary information filed with a comment, the agency does not place it in the docket. The FAA holds it in a separate file to which the public does not have access, and the agency places a note in the docket that it has received it. If the FAA receives a request to examine or copy this information, the FAA treats it as any other request under the Freedom of Information Act, 5 U.S.C. 552. The FAA processes such a request under the DOT procedures found in 49 CFR part 7.

Availability of Rulemaking Documents

You can get an electronic copy using the Internet by:

(1) Searching the Federal eRulemaking portal at *http://www.regulations.gov;*

(2) Visiting the FAA's Regulations and Policies web page at *http://www.faa.gov/regulations_policies/;* or

(3) Accessing the Government Printing Office's web page at *http://www.gpoaccess.gov/fr/index.html.*

You can also get a copy by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267–9680. Make sure to identify the docket and amendment numbers of this rulemaking.

I. Background

On August 25, 2006, the FAA issued requirements designed for an expendable launch vehicle (ELV) to avoid natural and triggered lightning during flight. *Licensing and Safety Requirements for Launch,* 71 FR 50508 (Aug. 25, 2006). An ELV is an unmanned rocket that typically carries satellites to orbit. ELVs carry large amounts of fuel and, due to the explosive nature of the fuel, may not be permitted to reach populated areas in the event they go off course. In the United States, safety for ELVs is achieved by use of a flight termination system. A flight termination system prevents an errant launch vehicle from reaching a populated area by destroying the vehicle. A flight termination system consists of all components on board a launch vehicle that provide the ability to end its flight in a controlled manner. Without the restrictions mandated by appendix G of part 417, a lightning strike could disable a flight safety system yet allow continued flight of the launch vehicle without a launch operator being able to stop its flight.

By codifying appendix G, the FAA implemented criteria developed by a Lightning Advisory Panel (LAP) to the National Aeronautics and Space Administration (NASA) and the U.S. Air Force. *See* Merceret et al., ed., *A History of the Lightning Launch Commit Criteria and the Lightning Advisory Panel for America's Space Program,* NASA/SP–2010–216283, 124, par. 25 (Aug. 2010) (*A History of the Lightning Criteria*) and *Rationales for the Lightning Flight-Commit Criteria, NASA/TP–2010–216291,* (Oct. 7, 2010)(*Rationales for Lightning Criteria*). Appendix G's flight commit criteria impose time and distance restrictions on launch, requiring a launch operator to wait to initiate flight for specified amounts of time after a lightning strike or when launch would take a flight path too close to an electrified cloud.

In this direct final rule, the FAA is permitting greater launch availability. In brief, the FAA is reducing requirements that a launch operator wait to launch by expanding the applicability of certain exceptions and recognizing that the risk of triggering lightning is less than previously understood at distances closer than previously believed. The FAA is also codifying criteria for obtaining accurate radar reflectivity measurements to ensure calculation of the volume-averaged, height-integrated radar reflectivity (VAHIRR) and other measurements, such as the vertical extent of a cloud top, are representative of actual conditions at the time of launch, because these calculations are instrumental in determining the presence of and risk posed by electrified clouds.

II. New Requirements

A. General Applicability

The FAA is revising the general description of appendix G to clarify that the flight commit criteria are to mitigate lightning strikes and avoid initiation of lightning when a launch vehicle flies near or through a highly electrified environment in or near a cloud. The FAA is also clarifying that, when a launch operator uses optional equipment, such as a field mill, to increase launch availability, an operator may not ignore data that does not satisfy the requirement. This addition, particularly when read in conjunction with 14 CFR 417.113(c)(1)(ii), should ensure that a launch takes place only when it is clear that all the criteria are satisfied. Section 417.113(c)(1)(ii) states that a launch operator's launch safety rules [1] must ensure there is clear and convincing evidence that the criteria of appendix G, which apply to the conditions present at the time of lift-off, are not violated. Section G417.1 states that *all* lightning flight commit criteria of Appendix G must be satisfied. In other words, each paragraph of each section must be individually satisfied at the time of launch. In short, the burden is on the launch operator to ensure that conditions are safe for launch.

A launch operator must understand that each of the sections of appendix G deliberately *prohibits* launch under certain conditions. Since all of the criteria must be satisfied, appendix G must be read in its entirety to determine whether or not launch is prohibited. Thus, the satisfaction of any particular paragraph or section cannot be considered to *permit* launch. Even the simultaneous satisfaction of all sections means only that there are no known natural- or triggered-lightning threats that prohibit launch. According to § 417.113(c)(1)(ii), it is still necessary for the launch weather team to report any other hazardous conditions to the person with authority for deciding whether or not to launch.

B. New Definitions and Clarifications of Existing Definitions

Section G.417.3 of appendix G defines terms if they would not be familiar to a trained meteorological observer, such as "field mill," or if they constitute non-standard usage of an otherwise familiar term, such as "associated." The FAA is adding new definitions, clarifying existing ones, and making minor editorial changes to others. For terms not defined in this section, a useful reference is the AMS Glossary of Meteorology, American Meteorological Society, 2000: Glossary of Meteorology, 2nd ed., American Meteorological Society, Boston, MA, 850; also available on line at *http://amsglossary.allenpress.com/glossary.*

New definitions to appendix G include definitions of *Cone of silence, Electric field, Horizontal distance, Radar reflectivity,* and *Slant distance.*

A cone of silence is a volume within which a radar cannot detect any object and is an inverted circular cone centered on the radar antenna. A cone of silence consists of all elevation angles greater than the maximum elevation angle reached by the radar. The cone of silence is a volume that the radar beam cannot access because of a radar's maximum tilt elevation. Radar echoes close to and directly above the radar cannot be detected. The methodology of section G417.25(b) provides that the specified volume for the VAHIRR calculation must not contain any portion of the cone of silence. Note as well that, for any given search pattern, certain sectors may be blocked out for reasons of payload safety, and the specified volume also may not contain any portion of a sector blocked out for these reasons. The methodology of section G417.25(a) also provides that no other radar reflectivity measurements, such as those used to delineate a cloud, may be affected by any volume that is inaccessible to the radar.

An electric field is a vertical electric field (Ez) at the surface of the Earth. This definition differentiates the surface electric field from those measured aloft.

A horizontal distance is a distance that is measured horizontally between a field mill or electric-field-measurement point and the nearest part of the vertical projection of an object or flight path onto the surface of the Earth. The FAA is defining horizontal distance in order to distinguish between the measurement of this two-dimensional distance and the three-dimensional "slant distance."

Radar reflectivity means the radar reflectivity factor due to hydrometeors, in dBZ. This is non-standard usage of a term that is defined in the Glossary of Meteorology. Radar reflectivity measurements in units of dBZ (as defined in the Glossary and not further discussed herein) are further specified in section G417.25(a) and are used throughout this appendix, including for the calculation of VAHIRR.

A slant distance means the shortest distance between two points, whether horizontal, vertical, or inclined in three dimensional space. A slant distance is used in measuring the distance between a radar reflectivity or VAHIRR measurement point and either a flight path or an object such as a cloud.

The FAA is also clarifying the definitions of *Associated, Cloud, Disturbed weather, Flight path, Transparent,* and *Volume-averaged height-integrated radar reflectivity* (VAHIRR). The following paragraphs describe the changes made to these definitions and the reasons for those changes.

Associated means two or more clouds are caused by the same disturbed weather or are physically connected. The FAA is deleting the discussion contained in the current definition. Discussion is better placed in explanatory material like this preamble, and is unnecessary in regulatory text. Accordingly, it is still the case that "associated" does not have to mean occurring at the same time. It is also still the case that a cumulus cloud formed locally and a cirrus layer physically separated from that cumulus cloud and generated by a distant source are not associated, even if they occur over or near the launch point at the same time.

A cloud is a visible mass of suspended water droplets, ice crystals, or a combination of water droplets and ice crystals. A "cloud" includes the entire volume containing such particles. This clarification omits an unnecessary reference to the particles being produced by condensation of water vapor in the atmosphere. Note that this definition works together with that of "slant distance" to specify that standoff distances from a cloud be measured from the nearest edge of that cloud.

Disturbed weather is a weather system where a dynamical process destabilizes the air on a scale larger than individual clouds or cells. Disturbed weather specifically includes, but is not limited to, fronts, troughs, and squall lines. (In

[1] A launch operator must follow its safety rules. 14 CFR 417.113(a)(3).

this case, the examples are retained as a critical part of the definition.) The body of the definition remains unchanged, but the FAA is now adding a squall line as an important example of disturbed weather because, along with fronts and troughs, it is frequently related to electrification of the associated clouds.

Flight path means a launch vehicle's planned flight trajectory, including the trajectory's vertical and horizontal uncertainties resulting from all three-sigma guidance and performance deviations. The FAA is no longer referencing wind effects because three-sigma dispersions already take wind effects into account.

The definition of *transparent* is clarified to mean any of the following conditions apply:

➢ Objects above, including higher clouds, blue sky, and stars are not blurred, are distinct, and are not obscured when viewed at visible wavelengths;

➢ Objects below, including terrain, buildings, and lights on the ground, are clear, distinct, and not obscured when viewed at visible wavelengths;

➢ Objects above or below are seen distinctly not only through breaks in a cloud;

➢ The cloud has a radar reflectivity of less than 0 dBZ.

Historically, transparency has been determined by a person watching the sky. The weather experts at the Federal launch ranges prefer observations undertaken by a person. Rather than limiting visual observations to those made by a person standing outdoors, this definition reflects the fact that transparency may be determined by satellite or camera as well. A person may also look at images of the conditions outside to ascertain transparency. For these reasons, the phrase "at visible wavelengths" has been retained; clouds that look transparent to a human observer may not look transparent to an imaging sensor operating at another wavelength, and vice versa.

Volume-averaged height-integrated radar reflectivity means the product, expressed in units of dBZ-km, of the volume-averaged radar reflectivity (in dBZ) and the average cloud thickness (in kilometers) in the specified volume determined by a VAHIRR-measurement point. The old definition states that the calculation applies to "a specified volume relative to a point along the flight track." The change clarifies that VAHIRR may be computed at points other than along a flight path. New section G417.25(b) describes in detail how VAHIRR is calculated.

Additionally, the FAA is making minor editorial changes to the following definitions: *Anvil cloud, Precipitation, Moderate precipitation, Thick cloud layer, Triboelectrification,* and *Volume-averaged height-integrated radar reflectivity.*

The FAA is also deleting several definitions.

Cloud edge is being deleted because it is now part of the definition of a cloud. *Electric field measurement at the surface of the Earth* is being deleted. The criteria this term contained are more accurately characterized as requirements, and, therefore, now appear in new section G417.25(c) *Electric field measurement,* which governs how to measure electric fields. *Electric field measurement aloft* is removed because Appendix G contains no criteria for electric field measurement aloft in the regulations. Although the FAA initially considered criteria for electric fields aloft, in the end, it did not promulgate requirements when it issued part 417. The definition was inadvertently left in the final rule. The definition of *Ohms/square* is removed because the term is a standard unit of measurement. The definition of *Specified volume* is no longer necessary because the term contained requirements now located in section G417.25. *Treated* is being deleted because it contained requirements now located in section G417.23(b). *Within* is being deleted because more precise language regarding the distance between a flight path and a cloud should prevent any misunderstanding regarding the distance for which a launch operator must account.

III. Changes to Temperature, Time, and Distance Restrictions for Anvil and Debris Clouds

In this direct final rule, the FAA is permitting greater launch availability. In brief, the FAA is reducing requirements that a launch operator wait to launch by expanding the applicability of certain exceptions and decreasing waiting time requirements because of recognition that the risk of triggering lightning is less than previously understood at distances closer than previously believed. In order to ensure satisfaction of minimum standards of measurement and uniformity across launch sites, the FAA is codifying in new section G417.25 the measurement criteria used during a second airborne field mill campaign (ABFM–II) conducted during 2000 and 2001. A lightning advisory panel that provides expertise to the Air Force and NASA recommended this approach to the ranges. The FAA also accepts the more simple approach that the ranges currently use to calculate volume-averaged, height-integrated radar reflectivity because it is more conservative than the codified approach. Acceptable techniques to calculate VAHIRR are further discussed in Section III.C.3 below.

A. Structural Changes

At the outset, the FAA must note that the order of the new requirements for anvil and debris clouds is reversed from the old requirements. These new rules have also been written so that only one set of restrictions applies at a time. For example, for attached anvil clouds, in old section G417.9.

- Paragraph (a) contains requirements for flight paths through or within 10 nautical miles of the cloud,
- Paragraph (b) contains requirements for flight paths through or within 5 nautical miles of the cloud, and
- Paragraph (c) contains requirements for flight paths through a cloud.

This organization is potentially confusing, since all three paragraphs apply to flight through, and both paragraphs (a) and (b) apply to flight within 5 nautical miles of, the cloud. The application has been simplified in the new G417.9, where—

- Paragraph (b) contains all requirements for flight paths through a cloud,
- Paragraph (c) contains all requirements for flight paths greater than 0 and less than or equal to 3 nautical miles from the cloud,
- Paragraph (d) contains all requirements for flight paths greater than 3 and less than or equal to 5 nautical miles from the cloud, and finally,
- Paragraph (e) contains all requirements for flight paths greater than 5 and less than or equal to 10 nautical miles from a cloud.

Whereas more than one paragraph could apply under the old rule, the end result of this restructuring is that, for any given slant distance from a cloud, at most, one paragraph will apply in the new rule. For example, suppose a launch vehicle's flight path would place the closest approach of the vehicle 2 nautical miles from an attached anvil cloud. Under the old rule, the operator would need to satisfy the requirements of both sections G417.9(a), because 2 nautical miles is less than 10 nautical miles, and G417.9(b), because 2 nautical miles is less than 5 nautical miles. Under the new rule, the operator only needs to satisfy the requirements of G417.9(c) because 2 nautical miles is between zero and 3 nautical miles. This change should make the rules easier to follow. However, because of this

restructuring, there is not a one-to-one correspondence between the paragraphs of the old and new rules.

Even in the rules that have been structurally rearranged, it must be remembered that slant distance from a cloud refers only to the closest approach of the vehicle. Otherwise multiple paragraphs may still be taken to apply. An operator must always take care that all paragraphs are satisfied.

B. Clarification of Applicability of Restrictions to Anvil Clouds Formed From Parents at Altitudes below −10 Degrees Celsius

Under new paragraphs (a) of sections G417.9 and G417.11, for both attached and detached anvil clouds, the requirements to wait before initiating flight apply only when an anvil cloud forms from a parent cloud that has a top at an altitude where the temperature is −10 degrees Celsius or colder. Even though anvil clouds can form in temperatures slightly above freezing, only anvil clouds with parents whose tops are at altitudes with temperatures at or below −10 degrees Celsius pose a real possibility of containing high electric fields.[2] When a convective cloud grows through different altitudes, it may reach altitudes with freezing or colder temperatures. At these altitudes the cloud may acquire ice particles, ice crystals, super-cooled water droplets or a combination thereof. It is primarily this mixture of phases that can produce a strong electrical generator within the cloud. When the cloud top has become colder than −10 degrees Celsius, the cloud is likely to be electrified, and when its top has become colder than −20 degrees Celsius, strong electrification is likely.[3]

The temperature criterion in paragraphs (a) applies to the parent cloud. Anvil clouds are limited to outflow from convective clouds at altitudes with temperatures at or colder than −-10 degrees Celsius. According to studies, anvil clouds that develop from cumulus clouds with cloud top temperatures warmer than −10 degrees Celsius rarely develop electric fields with the strength of a thunderstorm.[4]

In practice, this limitation of the flight commit criteria to anvil clouds formed from parents at sufficiently cold altitudes is not new. Although not clearly expressed in the old appendix G, the Federal ranges have historically limited their restrictions on flight to non-transparent anvil clouds formed from parents at altitudes where the temperatures are −10 degrees Celsius or colder.

C. Exceptions to the Requirement To Wait To Initiate Flight

This rulemaking increases the availability of exceptions to certain prohibitions on initiating flight under circumstances posing a risk of natural or triggered lightning. Specifically, although an FAA licensee must wait specified amounts of time after the last lightning discharge to initiate flight through a non-transparent attached or detached anvil cloud or a non-transparent debris cloud, the licensee need not wait, under the new versions of the anvil and debris-cloud rules, if all of the non-transparent anvil or debris clouds within 3 nautical miles of a flight path are located at altitudes where the temperature is colder than 0 degrees Celsius and if the volume-averaged, height-integrated radar reflectivity (VAHIRR) is less than +10 dBZ-km. For the longer standoff distances, anvil clouds must be cold within 10 nautical miles, but there is no requirement to calculate VAHIRR.

The launch operator must always remember, however, that all sections of Appendix G must be satisfied simultaneously. In particular, section G417.5, requires standoff distances of 10 nautical miles from a parent thunderstorm and from the lightning itself, so there will usually be portions of a non-transparent anvil or debris cloud through which flight is prohibited by the lightning provision even though it may not be prohibited by the anvil or debris cloud requirements themselves.

1. Reduced Restrictions on Launches With a Flight Path Greater Than 3 Nautical Miles From an Anvil or Debris Cloud

The first change reduces some restrictions on launches with a flight path greater than 3 nautical miles from a non-transparent anvil or debris cloud. For flight paths more than 3 nautical miles from a non-transparent anvil cloud, rather than requiring that a launch operator always wait after a lightning discharge, the FAA now requires only that the altitude of the portion of the cloud within a specified distance of the flight path be at temperatures less than 0 degrees Celsius to permit flight. For non-transparent debris clouds with flight paths greater than 3 nautical miles from the cloud, the FAA will no longer require any waiting after a lightning discharge or detachment.

For non-transparent anvil clouds, the requirements for a waiting period for flight paths more than 3 nautical miles from a cloud are not being dropped entirely. However, the requirements for anvil clouds will be more flexible beyond 3 nautical miles than they are under the current rules. For anvil clouds more than 3 nautical miles from a flight path, the FAA will require, unless the operator waits 3 hours after the last lightning discharge, that the altitudes at which the flight path passes within a specified distance of the cloud have temperatures of less than 0 degrees Celsius. This restriction was based on the first Airborne Field Mill campaign (ABFM–II) which showed that clouds at altitudes with temperatures of less than 0 degrees Celsius do not contain electric field magnitudes of greater than 3 kV/m. Merceret et al., *supra,* 242. The specific rule changes for attached and detached anvil clouds are explained in turn below. The reasons for the changes follow these descriptions.

i. Attached Anvil Clouds (G417.9)

A launch operator using flight paths of greater than 3 and less than or equal to 5 nautical miles from an attached non-transparent anvil cloud will no longer always need to wait 30 minutes after a lightning discharge, and will no longer need to show that the VAHIRR is less than 33 dBZ-kft within 3 hours of a lightning discharge. The old requirement is contained in both section G417.9(a), which requires waiting for 30 minutes after a lightning discharge regardless of distance, and in section G417.9(b), which only allows passage between 30 minutes and 3 hours after a lightning discharge, if the VAHIRR measurement is under +33 dBZ-kft and the altitudes at which the flight path passes within 5 nautical miles of the cloud have temperatures of less than 0 degrees Celsius.

Under the new requirements, the restriction applicable to flight paths between 3 and 5 nautical miles will be contained in section G417.9(d) and will require waiting for 3 hours after a lighting discharge *unless,* as with the old rule, the portion of the attached anvil cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius. A launch operator will no longer be required to wait for 30 minutes after a lightning discharge and will not need to calculate VAHIRR to be able to launch within 3

[2] Willett, ed., *Rationales for Lightning Criteria,* at 9, 45, 61, and 108.

[3] *Id.* at 45.

[4] Dye, J.E., W.P. Winn, J.J. Jones, and D.W. Breed, 1989: The electrification of New Mexico Thunderstorms. 1. Relationship between precipitation development and the onset of electrification, *J. Geophys. Res.*, **94**, 8643–8656. Breed, D.W., and J.E. Dye, 1989: The electrification of New Mexico Thunderstorms Part 2. Electric field growth during initial electrification. *J. Geophys. Res,* **94**, 14, 841–14, 854.

hours of a lightning discharge. However, a launch operator will still need to show satisfaction of the temperature at altitude restriction in order to launch within 3 hours of a lightning discharge.

Launch operators with flight paths of greater than 5 and less than or equal to 10 nautical miles from an attached non-transparent anvil cloud will no longer always need to wait 30 minutes after a lightning discharge as required by old section G417.9(a). Section G417.9(e) will now require waiting 30 minutes *unless* the portion of the attached anvil cloud at a slant distance of less than or equal to 10 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius.

ii. Detached Anvil Clouds (G417.11)

Launch operators with flight paths between 3 and 10 nautical miles from a detached non-transparent anvil cloud will no longer always need to wait 30 minutes after a lightning discharge and will no longer need to meet any requirements once 30 minutes have passed since the last lightning discharge. The new G417.11(d) will require that the launch operator wait 30 minutes after a lightning discharge from the cloud *unless* the portion of the detached anvil cloud at a slant distance of less than or equal to 10 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius. Section G417.11(a) currently requires that a launch operator wait 30 minutes after a lightning discharge, without the benefit of any exceptions. Additionally, current G417.11(b) does not allow a launch operator to pass between 3 and 5 nautical miles from a cloud between 30 minutes and 3 hours after a lightning discharge unless one of two sets of conditions are met. The new requirements are more flexible because they allow an exception to the requirement that the launch operator wait 30 minutes after a lightning discharge and because they do not require any conditions to be met after 30 minutes, even between 3 and 5 nautical miles.

iii. Rationale

The reduced restrictions on a flight path in excess of 3 nautical miles of a cold [5] anvil or debris cloud arise out of experimental and statistical work performed by the LAP, which recommends lightning requirements for launches at Federal launch ranges. The LAP has performed statistical analyses of data collected during ABFM–II. The goal of ABFM–II was to characterize the electric fields of anvil and debris clouds by flying an aircraft into these types of clouds while taking measurements at various distances from the clouds using electric field mills. The ABFM II campaign used aircraft carrying airborne field mills to measure the electric fields of clouds of interest. The campaign used ground-based radar to measure the reflectivity of the same clouds so that it would be possible to correlate the radar reflectivity of the clouds with the electric field measurements of the airborne field mills. Francis J. Merceret, et al., *On the Magnitude of the Electric Field near Thunderstorm-Associated Clouds,* 47 Journal of Applied Meteorology and Climatology 240, 243 (2008). These data were used to develop the VAHIRR parameter associated with cloud electrification. Both the temperature and VAHIRR criteria are correlated with mixed-phase precipitation, namely, the presence of water in both solid and liquid phases.

When a cloud spans the freezing level, the cloud can acquire a charge due to processes involving the mixing of liquid water droplets and ice crystals. A build up of electric charge in a cloud can lead to natural or triggered lightning. When the VAHIRR is less than 10 dBZ-km, it means that any mixed phase processes are unable to produce significant charging.

Like the Air Force and NASA before it, the FAA's existing triggered lightning criteria are based on the determination that a launch vehicle will not trigger lightning in an electric field with a magnitude of less than 3 kilovolts per meter (kV/m). The following discussion of each of the changes to the FAA's lightning commit criteria will, therefore, focus on showing how the FAA's new requirements ensure that the electric field magnitude along the flight path will be less than 3 kV/m, so that the new requirements will be essentially as safe as the current requirements.

Therefore, the FAA is able to follow the Federal launch range's lead in making the rules less restrictive because of new analyses of the ABFM–II data. T.P. O'Brien & R. Walterscheid, *Supplemental Statistical Analysis of ABFM–II Data for Lightning Launch Commit Criteria,* Aerospace Report No. TOR–2007(1494)–6, 3 (2007).

As a purely qualitative matter, out of 158 flights through non-transparent debris or anvil clouds during ABFM–II, the field mills detected no electric field with a magnitude of greater than 3 kV/m outside of a cloud. This was so even though the sample contained 30 flights through clouds with an electric field magnitude of more than 3 kV/m somewhere inside the cloud. *Id.*

Based on the data obtained, a qualitative analysis shows that flying more than 3 nautical miles from a non-transparent anvil cloud is as safe as the FAA's current requirements. The LAP also used this data to demonstrate statistically in two ways that it is extremely unlikely that the electric field magnitude will be more than 3 kV/m at distances greater than 3 nautical miles from the clouds.

A launch operator may calculate VAHIRR to help determine whether it is safe to fly, even if there has been a relatively recent lightning discharge. If the VAHIRR is less than 10 dBZ-km (about 33 dBZ-kft), the probability of an electric field of greater than 3 kV/m occurring is less than 1 in 10,000. Dye et al., *supra,* 14.

Calculating VAHIRR consists of multiplying the average cloud thickness and the average radar reflectivity found in a column with an 11 kilometer by 11 kilometer cross-section centered on a point of interest, where the two sides are oriented north-south and east-west. Because 3 nautical miles is 5.52 kilometers, a VAHIRR box centered on a flight path more than 3 nautical miles from the anvil cloud's edge will not contain the anvil cloud and will, therefore, have a radar reflectivity of zero, meaning that the VAHIRR will be zero. Because zero is clearly less than +33 dBZ-kft, flight at more than 3 nautical miles from the cloud will be at least as safe as the current requirements of G417.9(b)(2) and G417.11(b)(2)(ii), which only require a VAHIRR of less than +33 dBZ-kft. James E. Dye, et al., *Analysis of Proposed 2007–2008 Revisions to the Lightning Launch Commit Criteria for United States Space Launches,* 13th Conference on Aviation, Range and Aerospace Meteorology 8.2, 2–3 (available at *http://ams.confex.com/ams/88Annual/techprogram/programexpanded_474.htm*) (2008); Francis J. Merceret, *Risk Analysis of Proposed Reduction of Anvil and Debris Cloud LLCC Standoff Distances from Five to Three Miles,* 1–2 (2007) (internal LAP memorandum).

The LAP also performed a Gaussian statistical analysis on the electric field data collected between 6 kilometers (3.2 nautical miles) and 12 kilometers (6.5 nautical miles) from anvil and debris clouds in an attempt to determine the likelihood of various electric field magnitudes occurring at those distances from the clouds. The LAP found that an electric field of significance was highly unlikely.

[5] For the sake of brevity, the references to "cold" anvil clouds in this discussion refer to those whose parent clouds have tops at an altitude where the temperature is equal to or colder than −10 degrees Celsius.

The LAP used a Gaussian distribution to perform a conservative three-sigma worst-case risk analysis by using an assumed mean of three times the measured mean and an assumed error estimate of three times the calculated error. The LAP concluded that, even with these conservative assumptions, the probability that an electric field with a magnitude of 3 kV/m would occur within 3.2 to 6.5 nautical miles of a non-transparent anvil or debris cloud was negligible; the probability of a field of even 2 kV/m was on the order of 10^{-7}. Dye et al., *supra,* at 3–4. These probabilities were obtained by only analyzing non-transparent clouds that typically contain elevated electric fields, namely, those that somewhere contained electric fields greater than 3 kV/m. Merceret, *supra,* at 2–6. The FAA concludes from this analysis that launches more than 3 nautical miles from anvil and debris clouds are unlikely to trigger lightning because it is extremely remote for the electric field to reach a magnitude of 3 kV/m at distances more than 3 nautical miles from these clouds.

However, this analysis uses an unconventional technique for extreme value analysis. Gaussian analysis is not typically used to determine the likelihood of a quantity that is relatively far from any of the observed quantities. Therefore, the LAP also performed a second statistical analysis. Dye et al., *supra,* at 4–5.

The LAP used a second statistical method to determine the probability of the electric field magnitude exceeding 3 kV/m at various distances from the anvil and debris clouds in increments of 0.6 kilometers (0.32 nautical miles) and again found it extremely unlikely. O'Brien & Walterscheid, *supra,* at 7. Gaussian distributions are not necessarily well suited to extrapolating fits to the wings of a frequency distribution where the event frequency (in this case the frequency of fields exceeding 3 kV/m) is very small. A widely used function for extreme value estimation is the Weibull function. For each distance increment from the clouds, a 2-parameter Weibull distribution was a good statistical fit for the data. Extrapolating the tail of the Weibull shows how likely it would be at each increment to encounter an electric field with a magnitude greater than 3 kV/m. Even at 0.6 kilometers (0.32 nautical miles) from the cloud's edge, the probability of exceeding 3 kV/m was on the order of 10^{-9}. If only clouds containing an electric field of over 3 kV/m were considered, the calculated probability was somewhat lower, but this is most likely a statistical artifact relating to sample size. At 5.4 kilometers (2.9 nautical miles), the probability was under 10^{-16} even if only clouds containing an electric field of over 3 kV/m were considered. O'Brien & Walterscheid, *supra,* at 7.

Therefore, the FAA concludes that the risk of encountering electric field magnitudes greater than 3 kV/m is very small if the flight path is more than 3 nautical miles from the edge of an anvil or debris cloud. In fact, the Weibull fit analysis indicates that a launch would not likely encounter a field of 3 kV/m even if the flight path was at 0.32 nautical miles from the cloud's edge, so the requirements to wait or satisfy the VAHIRR criteria on launches with flight paths more than 3 nautical miles from a cloud's edge are not necessary.

iv. Reduced Restrictions on Launches With a Flight Path Within 3 Nautical Miles of a Debris Cloud

Analysis of the ABFM–II data has also demonstrated that satisfying the VAHIRR criteria can allow greater launch opportunities near a non-transparent debris cloud that has discharged lightning. This change expands launch availability because at any distance from a cloud the regulations permit flight if the conditions satisfy the VAHIRR and temperature restrictions. For a flight path through a non-transparent debris cloud under old section G417.13(a), a launch operator must wait 3 hours after detachment or a lightning discharge without exception. New section G417.13(a) requires a launch operator to wait 3 hours only if the operator cannot demonstrate that the VAHIRR is below 10 dBZ-km (+33 dBZ-kft) and that every portion of the non-transparent debris cloud at a slant distance within 5 nautical miles of the flight path is at altitudes where the cloud has temperatures of less than 0 degrees Celsius.

For flight paths between 0 and 3 nautical miles from the debris cloud, the current section G417.13(b) requires waiting 3 hours unless the launch meets three conditions:

1. There is at least one working field mill within 5 nautical miles of the cloud,

2. The magnitude of the electric field measurements has been less than 1 kV/m for 15 minutes within 5 nautical miles of the cloud, and

3. The maximum radar reflectivity has been less than 10 dBZ for 15 minutes within 5 nautical miles of the cloud.

The new requirements still allow the fulfillment of these three conditions as a method to avoid waiting the 3-hour period, but will also allow earlier flight if the operator meets the VAHIRR exception, and if every portion of the debris cloud at a slant distance within 5 nautical miles of the flight path is at altitudes where the cloud has temperatures of less than 0 degrees Celsius.

A VAHIRR measurement of less than 10 dBZ-km (or approximately 33 dBZ-kft), along with satisfactory field mill measurements and temperatures, means that a debris cloud does not contain an elevated electric field, even if portions of it are located at an altitude conducive to the creation of an electric charge. In fact, the VAHIRR method may be even more reliable when applied to non-transparent debris clouds than to anvil clouds. To demonstrate this, the LAP used a Weibull distribution to show that the upper bound of the 95-percent-confidence-interval for the probability of the electric field exceeding 3 kV/m if the VAHIRR measurement is between 5 and 15 dBZ-km is on the order of 10^{-5} for debris clouds, as opposed to 10^{-2} for anvil clouds. The expected value of the probability of exceeding 3 kV/m is much less. A more detailed examination demonstrated that the expected value of the probability of exceeding 3 kV/m for anvil clouds is 10^{-4} if the VAHIRR is less than 10 dBZ-km, so the probability of exceeding 3 kV/m for debris clouds is probably even lower than 10^{-5} if the VAHIRR is less than 10 dBZ-km. Dye et al., *supra,* 4–5. Therefore, the FAA has concluded that it is appropriate to extend the availability of the VAHIRR exception to waiting to launch to debris clouds.

2. Changes for Launches With a Flight Path Within Three Nautical Miles of an Attached Anvil Cloud

For flight paths within 3 nautical miles of a cold, non-transparent anvil cloud, the FAA will now permit flight within 30 minutes of a lightning discharge when temperature and VAHIRR readings satisfy the regulatory criteria. Therefore, for flight paths between 0 and 3 nautical miles from a cloud, the new section G417.9(c) allows launch at any time if the VAHIRR is below 10 dBZ-km and every portion of the anvil cloud at a slant distance within 5 nautical miles of the flight path is at altitudes where the non-transparent cloud has temperatures of less than 0 degrees Celsius. The old rule requires waiting for 30 minutes after lightning discharge if not passing through the non-transparent cloud (current G417.9(a) and (b)) or 3 hours after lightning discharge if passing through the non-transparent cloud (current G417.9(c)) unless VAHIRR and temperature at altitude conditions are

met. The new requirements will allow VAHIRR and the temperature at altitude conditions to always be an alternative to having to wait after a lightning discharge. For detached non-transparent anvil clouds, the requirements remain the same for flight paths less than or equal to 3 nautical miles except that now a launch operator can pass within 3 nautical miles of the non-transparent cloud within 30 minutes of a lightning discharge if the VAHIRR is below 10 dBZ-km and every portion of the non-transparent cloud at a slant distance within 5 nautical miles of the flight path is at altitudes where the cloud has temperatures of less than 0 degrees Celsius. This change is contained in G417.11(c)(1). This change is possible because the studies of the ABFM–II campaign show, as discussed above, that electric fields greater than 3 kv/m do not extend as far and the decay rate is much more rapid near the anvil edge [6] than previously believed. Cloud charges decay in time in the absence of active charge generation and, real-time radar reflectivity readings and calculations may be used to confirm that the electric field has, in fact, subsided to acceptable levels.

The FAA will not require a launch operator to wait 30 minutes when temperature and VAHIRR readings satisfy the criteria for attached and detached non-transparent anvil clouds when the flight path is between 0 and 3 nautical miles. As described above, statistical analysis of the ABFM II measurements for all anvils shows that, even for highly electrified anvils with electric fields much greater than 3 kV/m inside the cloud, the electric field outside of the anvil cloud falls off very rapidly and once falling to low levels remains small at greater distances. O'Brien. et. al. at 9. For attached and detached non-transparent anvil clouds and debris clouds, when the electric field is strong, namely, when it exceeds 3 kV/m, the radar reflectivity in the same location over the ABFM II data set is invariably greater than approximately 10 dBZ. As noted, the Weibull distribution and extreme value analysis for anvil and debris clouds showed that, when VAHIRR is ≤ 10 dBZ-km, the probability of having electric fields in excess of 3 Kv/m is very small (on the order of 10^{-4} or lower). Based on these results, the FAA finds that a launch that meets the VAHIRR criterion obviates concerns regarding electric fields in excess of 3 kV/m. Strong electric fields are known to occur in the melting zone of many precipitating layer clouds.[7] Satisfaction of the temperature requirement ensures that this type of electric charging within the melting zone will not occur.

3. Codification of Measurement Criteria

New section G417.25 represents a codification of three different sets of measurement specifications. Section G417.25(a) contains requirements for accurate and reliable radar reflectivity measurements that qualify for use throughout the other sections of this appendix. In addition to VAHIRR calculations, such uses include all radar measurements of the location, spatial extent, and intensity of clouds and precipitation. Such specifications are currently applied by the U.S. Air Force and NASA at the Federal ranges and can also be met by correct application of data from the national Next-Generation Radar (NEXRAD) network.[8] If the available radar does not meet these requirements, a launch operator must fall back on visual and other observations to convincingly demonstrate that the rules are not violated.

Section G417.25(b) applies specifically to VAHIRR calculations and explains how valid VAHIRR measurements must be made. These specifications are the same as those used during the ABFM II of 2000 and 2001 from which a safe VAHIRR threshold of ≤10 dBZ-km was statistically determined for anvil and debris clouds. Because there is no guarantee that this threshold would be safe if VAHIRR were calculated operationally in a different way, the FAA is codifying these specifications here. See below, however, for an alternative calculation that is currently in use by the U.S. Air Force and NASA at the Eastern Range and that satisfies section G417.1(c) by being at least as safe as the FAA's requirements.

Finally, section G417.25(c) specifies the measurement techniques for electric fields to qualify for use in this appendix. Again, these are the specifications currently used by the federal launch ranges.

Section G417.25(a) requires that a licensee who relies on radar reflectivity measurements, including the calculation of VAHIRR, to increase launch availability must satisfy a number of requirements. The Federal launch ranges satisfy the requirements of paragraph (a) of this section because they employ meteorological radar,[9] and they ensure that—

(1) The radar wavelength is greater than or equal to 5 centimeters in order that attenuation by intervening clouds and/or precipitation not be significant; [10]

(2) Any reflectivity measurement is of a meteorological target, such as a cloud or precipitation, and not of some other objects, such as birds or insects, nor due to "anomalous propagation"; [11]

(3) The spatial accuracy and resolution of a reflectivity measurement is one kilometer or better in order that the locations and spatial extent of clouds—especially their critical altitudes and thicknesses—and of precipitation can be determined with sufficient accuracy for use in this appendix; [12]

(4) Any attenuation caused by precipitation or an accumulation of water or ice on the radome that protects the radar antenna is less than or equal to 1 dBZ because the requirements in this appendix can be met only with that degree of accuracy; [13] and

(5) A reflectivity measurement contains no portion of the cone of silence or other blocked out portion so that it is not giving a bogus indication.[14]

A launch operator who relies on VAHIRR to increase launch availability under this appendix must satisfy the requirements of both sections G417.25(a) and (b), or must otherwise ensure that its estimates of VAHIRR are at least as large as those that would result from section G417.25(b) to ensure that its invocation of any VAHIRR exceptions to these rules are at least as safe. The current requirements for calculating VAHIRR at the Federal launch ranges satisfy section G417.1(c) because they are more conservative, even though there are certain requirements of section G417.25(b) that they do not satisfy. The Federal launch ranges do not, as required by paragraph (b)(1), ensure that a digital signal processor provide radar reflectivity measurements on a three-dimensional

[6] Dye, J. E., *et al.* (2007), Electric fields, cloud microphysics, and reflectivity in anvils of Florida thunderstorms. J. Geophys. Res., 112, D11215, doi:10.1029/2006JD007550.

[7] *Rationales for Lightning Criteria,* at 123.

[8] NEXRAD is a network of 159 high-resolution Doppler weather radars operated by the National Weather Service, an agency of the National Oceanic and Atmospheric Administration (NOAA) within the United States Department of Commerce.

[9] The Federal launch ranges employ meteorological radars because other radars do not provide sufficient granularity in depicting reflectivity on a gridded representation.

[10] The radar used at the Eastern and Western Ranges is WSR–88D and WSR–74C. They meet this criterion.

[11] 45th Weather Squadron, Steps for Evaluating VAHIRR, par. 6 (March 2005.

[12] Blakeslee, R.J., H.J. Christian, and B. Vonnegut (1989), Electrical measurements over thunderstorms, J. Geophys. Res., 94, 135–140.

[13] 45th Weather Squadron, Steps for Evaluating VAHIRR, Par. 2, (March 2005).

[14] *A History of the Lightning Criteria,* 124, par. 25.

Cartesian grid having a maximum grid-point-to-grid-point spacing of one kilometer in each of the three dimensions. The ranges do, as required by paragraph (b)(2), ensure that the specified volume is bounded in the horizontal by vertical plane, perpendicular sides located 5.5 kilometers (3 nautical miles) north, east, south, and west of the point where VAHIRR is to be evaluated; on the bottom by the 0 degree Celsius level; and on the top by an altitude of 18 kilometers.[15] Note that the specified volume need not contain the VAHIRR evaluation point, which may be either below the lower boundary of that volume (as when the vehicle is on the launch pad) or above the upper boundary (as when the vehicle is flying high above an anvil cloud) of the specified volume.

To calculate VAHIRR a launch operator must compute both a volume averaged radar reflectivity and an average cloud thickness in a specified volume before multiplying them to obtain a value for VAHIRR. Neither of these quantities is available yet as an output product of the WSR–88D.[16] or WSR–74C radar systems that the Federal ranges use to support commercial launches.[17] Instead, the Federal ranges and NASA rely on Interim Instructions [18] for computing these quantities, which are more conservative and, thus, afford less launch availability than allowed by section G417.25(b).

Paragraph (c) of section G417.25 requires a launch operator who measures an electric field to comply with this appendix to—

- Employ a ground-based field mill in order to obtain a reliable and easily calibrated measurement with a relatively low-maintenance instrument;
- Use only the one-minute arithmetic average of the instantaneous readings from that field mill to minimize the effects of local space charge and lightning field changes;
- Ensure that all field mills are calibrated so that the polarity of the electric field measurements is the same as the polarity of a voltage placed on a test plate above the sensor as discussed in more detail below;
- Ensure that the altitude of the flight path of the launch vehicle is equal to or less than 20 kilometers (66 thousand feet) everywhere above a horizontal circle of 5 nautical miles centered on the field mill being used as discussed further below, and
- Use only direct measurements from a field mill. A launch operator may not interpolate based on electric-field contours because interpolation schemes are highly variable and can give unexpected results.

The Federal launch ranges use electric field mills that satisfy each of the requirements of paragraph (c) of section G417.25. Accordingly, no new methodology is being codified here.

Regarding the polarity of an electric field measurement, note that the required polarity is the opposite of the so-called "physics sign convention" that is now used almost exclusively in the atmospheric electricity literature. This older sign convention is retained here, however, because it has been in exclusive use at the Kennedy Space Center and the Eastern Range since the early days of the Launch Pad Lightning Warning System and it remains in use today.

The FAA is relaxing the requirements for field measurement by limiting the altitude of the flight path of the launch vehicle to less than 20 kilometers (66 thousand feet) everywhere above a horizontal circle of 5 nautical miles centered on the field mill. Electric field measurements above 20 kilometers are to be ignored.

Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. Therefore, any small entity that has a question regarding this document may contact their local FAA official, or the person listed under **FOR FURTHER INFORMATION CONTACT**. You can find out more about SBREFA on the Internet at *http://www.faa.gov/regulations_policies/rulemaking/sbre_act/.*

IV. Regulatory Analyses

Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The FAA has determined that this final rule has no new additional burden to respondents over and above that which the Office of Management and Budget already approved under the existing rule titled, "Commercial Space Transportation Licensing Regulations" (OMB 2120–0608).

International Compatibility

The FAA has determined that a review of the Convention on International Civil Aviation Standards and Recommended Practices is not warranted because there is not a comparable rule under ICAO standards.

Regulatory Evaluation, Regulatory Flexibility Determination, International Trade Regulatory Flexibility Determination

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency may propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies developing standards to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this direct final rule.

Department of Transportation Order DOT 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If the expected cost impact is so minimal that a proposed or final rule does not warrant a detailed evaluation, this order permits that a statement to that effect and the basis for it be included in the preamble if a full regulatory evaluation of the cost and benefits is not prepared. Such a determination has been made for this direct final rule. The reasoning for this determination follows. Note that the following discussion represents a gross simplification of the new requirements and that there is no safe substitute for reading the rules themselves.

These changes are being made because studies and data that were not available when the current regulations

[15] *Id.*

[16] Technical name for NEXRAD is WSR–88D, which stands for Weather Surveillance Radar, 1988, Doppler.

[17] *A History of the Lightning Criteria,* 124, par. J.

[18] *Id.* (describing the interim methodology).

were established have led the FAA to conclude that the intended level of safety can be maintained with fewer constraints on launch through and near anvil and debris clouds.

The FAA concluded from studies that a launch vehicle will not trigger lightning in a steady electric field with a magnitude of less than 3 kV/m. Furthermore, the Lightning Advisory Panel performed analyses which support the conclusion that the possibility of encountering electric field magnitudes of more than 3 kV/m is very small if the flight path is more than 3 nautical miles from an anvil or debris cloud's edge, provided that all other sections of Appendix G are also satisfied. Furthermore, quantitative studies from the LAP indicate that, if the VAHIRR is less than 10 dBZ-km (about 33 dBZ-kft), the probability of an electric field of greater than 3 kV/m occurring is less than 1 in 10,000 under these conditions.

With this rule, launch initiation may occur sooner and certainly no later than under current regulations. There will be fewer constraints on launch initiation because in some situations, fewer conditions will be needed to meet criteria for launch initiation and in other situations; alternative conditions that meet prescribed criteria will be accepted for launch initiation. Therefore, the rule will increase launch availability and likely decrease costs.

The direct final rule adds a section (G417.25) which describes the methods for calculating the VAHIRR currently accepted by the FAA. These precise methods are not prescribed in the current Code of Federal Regulations. The direct final rule codifies VAHIRR calculation methods and recognizes as acceptable the method used by the federal launch ranges, and therefore increases clarity. The direct final rule also reorganizes rule language and adds and changes definitions to enhance clarity of the rule language.

Since this direct final rule will be cost relieving without degrading safety, a regulatory evaluation was not prepared. FAA has, therefore, determined that this direct final rule is not a "significant regulatory action" as defined in section 3(f) of Executive Order 12866, and is not "significant" as defined in DOT's Regulatory Policies and Procedures.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration." The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA.

However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

This direct final rule is cost relieving, and thus is not expected to have a significant economic impact. Therefore as FAA Administrator, I certify this rule will not have a significant economic impact on a substantial number of small entities.

International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has found no comparable international standards. The FAA has assessed the potential effect of this direct final rule and determined that it will have only a domestic impact and therefore no affect on international trade.

Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a "significant regulatory action." The FAA currently uses an inflation-adjusted value of $140.8 million in lieu of $100 million. This direct final rule does not contain such a mandate; therefore, the requirements of Title II of the Act do not apply.

Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. We determined that this action will not have a substantial direct effect on the States, or the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, we determined that this final rule does not have federalism implications.

Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in Chapter 3, paragraph 312d, governing rulemakings such as this, and involves no extraordinary circumstances.

Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA has analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use, 66 FR 28355 (May 18, 2001). We have determined that it is not a "significant energy action" under the executive order because it is not a "significant regulatory action" under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

List of Subjects in 14 CFR Part 417

Space Safety, Space transportation and exploration.

The Amendments

In consideration of the foregoing, the Federal Aviation Administration amends Chapter I of Title 14 Code of Federal Regulations as follows:

PART 417—LAUNCH SAFETY

■ 1. The authority citation for part 417 is revised to read as follows:

Authority: 51 U.S.C. 50901–50923.

■ 2. Revise Appendix G to read as follows:

Appendix G to Part 417—Natural and Triggered Lightning Flight Commit Criteria

G417.1 General

This appendix provides flight commit criteria for mitigating against natural lightning strikes and lightning triggered by the flight of a launch vehicle through or near an electrified environment. A launch operator may not initiate flight unless the weather conditions at the time of launch satisfy all lightning flight commit criteria of this appendix.

(a) In order to meet the lightning flight commit criteria, a launch operator must employ any:

(1) Weather monitoring and measuring equipment needed, and

(2) Procedures needed to verify compliance.

(b) When equipment or procedures, such as a field mill or calculation of the volume-averaged, height-integrated radar reflectivity (VAHIRR) of clouds, are used with the lightning flight commit criteria to increase launch opportunities, a launch operator must evaluate all applicable measurements to determine whether the measurements satisfy the criteria. A launch operator may not turn off available instrumentation to create the appearance of meeting a requirement and must use all radar reflectivity measurements within a specified volume for a VAHIRR calculation.

(c) If a launch operator proposes any alternative lightning flight commit criteria, the launch operator must clearly and convincingly demonstrate that the alternative provides an equivalent level of safety to that required by this appendix.

G417.3 Definitions

For the purpose of this appendix:

Anvil cloud means a stratiform or fibrous cloud formed by the upper-level outflow or blow-off from a thunderstorm or convective cloud.

Associated means two or more clouds are caused by the same disturbed weather or are physically connected.

Bright band means an enhancement of radar reflectivity caused by frozen hydrometeors falling and beginning to melt at any altitude where the temperature is 0 degrees Celsius or warmer.

Cloud means a visible mass of suspended water droplets or ice crystals, or a combination of water droplets and ice crystals. The cloud is the entire volume containing such particles.

Cloud layer means a vertically continuous array of clouds, not necessarily of the same type, whose bases are approximately at the same altitude.

Cone of silence means the volume within which a radar cannot detect any object, and is an inverted circular cone centered on the radar antenna. A cone of silence consists of all elevation angles greater than the maximum elevation angle reached by the radar.

Debris cloud means any cloud, except an anvil cloud, that has become detached from a parent cumulonimbus cloud or thunderstorm, or that results from the decay of a parent cumulonimbus cloud or thunderstorm.

Disturbed weather means a weather system where a dynamical process destabilizes the air on a scale larger than the individual clouds or cells. Examples of disturbed weather include fronts, troughs, and squall lines.

Electric field means a vertical electric field (Ez) at the surface of the Earth.

Field mill means an electric-field sensor that uses a moving, grounded conductor to induce a time-varying electric charge on one or more sensing elements in proportion to the ambient electrostatic field.

Flight path means a launch vehicle's planned flight trajectory, and includes the trajectory's vertical and horizontal uncertainties resulting from all three-sigma guidance and performance deviations.

Horizontal distance means a distance that is measured horizontally between a field mill or electric field measurement point and the nearest part of the vertical projection of an object or flight path onto the surface of the Earth.

Moderate precipitation means a precipitation rate of 0.1 inches/hr or a radar reflectivity of 30 dBZ.

Non-transparent means that one or more of the following conditions apply:

(1) Objects above, including higher clouds, blue sky, and stars, are blurred, indistinct, or obscured when viewed from below when looking through a cloud at visible wavelengths; or objects below, including terrain, buildings, and lights on the ground, are blurred, indistinct, or obscured when viewed from above when looking through a cloud at visible wavelengths;

(2) Objects above an observer are seen distinctly only through breaks in a cloud; or

(3) The cloud has a radar reflectivity of 0 dBZ or greater.

Precipitation means detectable rain, snow, hail, graupel, or sleet at the ground; virga; or a radar reflectivity greater than 18 dBZ.

Radar reflectivity means the radar reflectivity factor due to hydrometeors, in dBZ.

Slant distance means the shortest distance between two ports, whether horizontal, vertical, or inclined, in three dimensional space.

Thick cloud layer means one or more cloud layers whose combined vertical extent from the base of the bottom cloud layer to the top of the uppermost cloud layer exceeds 4,500 feet. Cloud layers are combined with neighboring layers for determining total thickness only when they are physically connected by vertically continuous clouds.

Thunderstorm means any convective cloud that produces lightning.

Transparent means that any of the following conditions apply:

(1) Objects above, including higher clouds, blue sky, and stars, are not blurred, are distinct and are not obscured when viewed at visible wavelengths; or objects below, including terrain, buildings, and lights on the ground, are clear, distinct, and not obscured when viewed at visible wavelengths; (2) Objects identified in paragraph (1) of this definition are seen distinctly not only through breaks in a cloud; and (3) The cloud has a radar reflectivity of less than 0 dBZ.

Triboelectrification means the transfer of electrical charge between ice particles and a launch vehicle when the ice particles collide with the vehicle during flight.

Volume-averaged, height integrated radar reflectivity (VAHIRR) means the product, expressed in units of dBZ-km or dBZ-kft, of a volume-averaged radar reflectivity and an average cloud thickness in a specified volume corresponding to a point.

G417.5 Lightning

(a) A launch operator must wait 30 minutes to initiate flight after any type of lightning occurs in a thunderstorm if the flight path will carry the launch vehicle at a slant distance of less than or equal to 10 nautical miles from that thunderstorm. This paragraph does not apply to an anvil cloud that is attached to a parent thunderstorm.

(b) A launch operator must wait 30 minutes to initiate flight after any type of lightning occurs at a slant distance of less than or equal to 10 nautical miles from the flight path, unless:

(1) The non-transparent part of the cloud that produced the lightning is at a slant distance of greater than 10 nautical miles from the flight path;

(2) There is at least one working field mill at a horizontal distance of less than or equal to 5 nautical miles from each such lightning discharge; and

(3) The absolute values of all electric field measurements at a horizontal distance of less than or equal to 5 nautical miles from the flight path and at each field mill specified in paragraph (b)(2) of this section have been less than 1000 volts/meter for at least 15 minutes.

G417.7 Cumulus Clouds

(a) This section applies to non-transparent cumulus clouds, except for cirrocumulus, altocumulus, or stratocumulus clouds. This section does not apply to an anvil cloud that is attached to a parent cumulus cloud.

(b) A launch operator may not initiate flight if the slant distance to the flight path is less than or equal to 10 nautical miles from any cumulus cloud that has a top at an altitude where the temperature is colder than or equal to −20 degrees Celsius.

(c) A launch operator may not initiate flight if the slant distance to the flight path is less than or equal to 5 nautical miles from any cumulus cloud that has a top at an altitude where the temperature is colder than or equal to −10 degrees Celsius.

(d) A launch operator may not initiate flight if the flight path will carry the launch vehicle through any cumulus cloud with its

top at an altitude where the temperature is colder than or equal to −5 degrees Celsius.

(e) A launch operator may not initiate flight if the flight path will carry the launch vehicle through any cumulus cloud that has a top at an altitude where the temperature is colder than or equal to +5, and warmer than −5 degrees Celsius unless:

(1) The cloud is not producing precipitation;

(2) The horizontal distance from the center of the cloud top to at least one working field mill is less than 2 nautical miles; and

(3) All electric field measurements at a horizontal distance of less than or equal to 5 nautical miles of the flight path and at each field mill specified in paragraph (e)(2) of this section have been between −100 volts/meter and +500 volts/meter for at least 15 minutes.

G417.9 Attached Anvil Clouds

(a) This section applies to any non-transparent anvil cloud formed from a parent cloud that has a top at an altitude where the temperature is colder than or equal to −10 degrees Celsius.

(b) Flight path through cloud: If a flight path will carry a launch vehicle through any attached anvil cloud, the launch operator may not initiate flight unless:

(1) The portion of the attached anvil cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius; and

(2) The volume-averaged, height-integrated radar reflectivity is less than +10 dBZ-km (+33 dBZ-kft) at every point at a slant distance of less than or equal to 1 nautical mile from the flight path.

(c) Flight path between 0 and 3 nautical miles from cloud: If a flight path will carry a launch vehicle at a slant distance of greater than 0, but less than or equal to 3, nautical miles from any attached anvil cloud, a launch operator must wait 3 hours to initiate flight after a lightning discharge in or from the parent cloud or anvil cloud, unless:

(1) The portion of the attached anvil cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius; and

(2) The volume-averaged, height-integrated radar reflectivity is less than +10 dBZ-km (+33 dBZ-kft) at every point at a slant distance of less than or equal to 1 nautical mile from the flight path.

(d) Flight path between 3 and 5 nautical miles from cloud: If a flight path will carry a launch vehicle at a slant distance of greater than 3 and less than or equal to 5 nautical miles from any attached anvil cloud, a launch operator must wait 3 hours to initiate flight after every lightning discharge in or from the parent cloud or anvil cloud, unless the portion of the attached anvil cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius.

(e) Flight path between 5 and 10 nautical miles from cloud: If the flight path will carry the launch vehicle at a slant distance of greater than 5 and less than or equal to 10 nautical miles from any attached anvil cloud, the launch operator must wait to initiate flight for 30 minutes after every lightning discharge in or from the parent cloud or anvil cloud, unless the portion of the attached anvil cloud at a slant distance of less than or equal to 10 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius.

G417.11 Detached Anvil Clouds

(a) This section applies to any non-transparent anvil cloud formed from a parent cloud that had a top at an altitude where the temperature was colder than or equal to −10 degrees Celsius.

(b) Flight path through cloud: If the flight path will carry the launch vehicle through a detached anvil cloud, the launch operator may not initiate flight unless:

(1) The launch operator waits 4 hours after every lightning discharge in or from the detached anvil cloud; and observation shows that 3 hours have passed since the anvil cloud detached from the parent cloud; or

(2) Each of the following conditions exists:

(i) Any portion of the detached anvil cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius; and

(ii) The VAHIRR is less than +10 dBZ-km (+33 dBZ-kft) everywhere in the flight path.

(c) Flight path between 0 and 3 nautical miles from cloud: If a flight path will carry a launch vehicle at a slant distance of greater than 0 and less than or equal to 3 nautical miles from a detached anvil cloud, the launch operator must accomplish both of the following:

(1) Wait 30 minutes to initiate flight after every lightning discharge in or from the parent cloud or anvil cloud before detachment of the anvil cloud, and after every lightning discharge in or from the detached anvil cloud after detachment, unless:

(i) The portion of the detached anvil cloud less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius; and

(ii) The VAHIRR is less than +10 dBZ-km (+33 dBZ-kft) at every point at a slant distance of less than or equal to 1 nautical mile from the flight path; and

(2) If a launch operator is unable to initiate flight in the first 30 minutes under paragraph (c)(1) of this section, the launch operator must wait to initiate flight for 3 hours after every lightning discharge in or from the parent cloud or anvil cloud before detachment of the anvil cloud, and after every lightning discharge in or from the detached anvil cloud after detachment, unless:

(i) All of the following are true:

(A) There is at least one working field mill at a horizontal distance of less than or equal to 5 nautical miles from the detached anvil cloud;

(B) The absolute values of all electric field measurements at a horizontal distance of less than or equal to 5 nautical miles from the flight path and at each field mill specified in paragraph (c)(2)(i)(A) of this section have been less than 1000 V/m for at least 15 minutes; and

(C) The maximum radar reflectivity from any part of the detached anvil cloud at a slant distance of less than or equal to 5 nautical miles from the flight path has been less than +10 dBZ for at least 15 minutes; or

(ii) Both of the following are true:

(A) The portion of the detached anvil cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius; and

(B) The volume-averaged, height-integrated radar reflectivity is less than +10 dBZ-km (+33 dBZ-kft) at every point at a slant distance of less than or equal to 1 nautical mile from the flight path.

(d) Flight path between 3 and 10 nautical miles from cloud: If a flight path will carry a launch vehicle at a slant distance of greater than 3 and less than or equal to 10 nautical miles from a detached anvil cloud, the launch operator must wait 30 minutes to initiate flight after every lightning discharge in or from the parent cloud or anvil cloud before detachment, and after every lightning discharge in or from the detached anvil cloud after detachment, unless the portion of the detached anvil cloud at a slant distance of less than or equal to 10 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius.

G417.13 Debris Clouds

(a) This section applies to any non-transparent debris cloud whose parent cumuliform cloud has had any part at an altitude where the temperature was colder than −20 degrees Celsius or to any debris cloud formed by a thunderstorm. This section does not apply to a detached anvil cloud.

(b) A launch operator must calculate a "3-hour period" as starting at the latest of the following times:

(1) The debris cloud is observed to be detached from the parent cloud;

(2) The debris cloud is observed to have formed by the collapse of the parent cloud top to an altitude where the temperature is warmer than −10 degrees Celsius; or

(3) Any lightning discharge occurs in or from the debris cloud.

(c) Flight path through cloud: If a flight path will carry a launch vehicle through a debris cloud, the launch operator may not initiate flight during the "3-hour period," of paragraph (b) of this section, unless:

(1) The portion of the debris cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius; and

(2) The VAHIRR is less than +10 dBZ-km (+33 dBZ-kft) everywhere in the flight path.

(d) Flight path between 0 and 3 nautical miles from cloud: If the flight path will carry the launch vehicle at a slant distance of greater than or equal to 0 and less than or equal to 3 nautical miles from the debris cloud, the launch operator may not initiate flight during the "3-hour period," unless one of the following applies:

(1) A launch operator may initiate flight during the "3-hour period," of paragraph (b) of this section if:

(i) There is at least one working field mill at a horizontal distance of less than or equal to 5 nautical miles from the debris cloud;

(ii) The absolute values of all electric field measurements at a horizontal distance of less than or equal to 5 nautical miles from the flight path and at each field mill specified in paragraph (d)(1)(i) of this section have been less than 1000 volts/meter for at least 15 minutes; and

(ii) The maximum radar reflectivity from any part of the debris cloud less than or equal to a slant distance of 5 nautical miles from the flight path has been less than +10 dBZ for at least 15 minutes; or

(2) A launch operator may initiate flight during the "3-hour period," of paragraph (b) of this section if:

(i) The portion of the debris cloud at a slant distance of less than or equal to 5 nautical miles from the flight path is located entirely at altitudes where the temperature is colder than 0 degrees Celsius; and

(ii) The VAHIRR is less than + 10 dBZ-km (+33 dBZ-kft) at every point at a slant distance of less than or equal to 1 nautical mile from the flight path.

G417.15 Disturbed Weather

A launch operator may not initiate flight if the flight path will carry the launch vehicle through a non-transparent cloud associated with disturbed weather that has clouds with tops at altitudes where the temperature is colder than 0 degrees Celsius and that contains, at a slant distance of less than or equal to 5 nautical miles from the flight path, either:

(a) Moderate or greater precipitation; or

(b) Evidence of melting precipitation such as a radar bright band.

G417.17 Thick Cloud Layers

(a) This section does not apply to either attached or detached anvil clouds.

(b) A launch operator may not initiate flight if the flight path will carry the launch vehicle through a non-transparent cloud layer that is:

(1) Greater than or equal to 4,500 feet thick and any part of the cloud layer in the flight path is located at an altitude where the temperature is between 0 degrees Celsius and −20 degrees Celsius, inclusive; or

(2) Connected to a thick cloud layer that, at a slant distance of less than or equal to 5 nautical miles from the flight path, is greater than or equal to 4,500 feet thick and has any part located at any altitude where the temperature is between 0 degrees Celsius and −20 degrees Celsius, inclusive.

(c) A launch operator may initiate flight despite paragraphs (a)(1) and (a)(2) of this section if the thick cloud layer:

(1) Is a cirriform cloud layer that has never been associated with convective clouds,

(2) Is located entirely at altitudes where the temperature is colder than or equal to −15 degrees Celsius, and

(3) Shows no evidence of containing liquid water.

G417.19 Smoke Plumes

(a) A launch operator may not initiate flight if the flight path will carry the launch vehicle through any non-transparent cumulus cloud that has developed from a smoke plume while the cloud is attached to the smoke plume, or for the first 60 minutes after the cumulus cloud is observed to be detached from the smoke plume.

(b) This section does not apply to non-transparent cumulus clouds that have formed above a fire but have been detached from the smoke plume for more than 60 minutes. Section G417.7 applies.

G417.21 Surface Electric Fields

(a) A launch operator must wait 15 minutes to initiate flight after the absolute value of any electric field measurement at a horizontal distance of less than or equal to 5 nautical miles from the flight path has been greater than or equal to 1500 volts/meter.

(b) A launch operator must wait 15 minutes to initiate flight after the absolute value of any electric field measurement at a horizontal distance of less than or equal to 5 nautical miles from the flight path has been greater than or equal to 1000 volts/meter, unless:

(1) All clouds at a slant distance of less than or equal to 10 nautical miles from the flight path are transparent; or

(2) All non-transparent clouds at a slant distance less than or equal to 10 nautical miles from the flight path:

(i) Have tops at altitudes where the temperature is warmer than or equal to +5 degrees Celsius, and

(ii) Have not been part of convective clouds with cloud tops at altitudes where the temperature was colder than or equal to −10 degrees Celsius for 3 hours.

G417.23 Triboelectrification

(a) A launch operator may not initiate flight if the flight path will carry the launch vehicle through any part of a cloud at any altitude where:

(1) The temperature is colder than or equal to −10 degrees Celsius; and

(2) The launch vehicle's velocity is less than or equal to 3000 feet/second,

(b) Paragraph (a) of this section does not apply if either:

(1) The launch vehicle is treated for surface electrification so that:

(i) All surfaces of the launch vehicle susceptible to ice particle impact are such that the surface resistivity is less than 10^9 Ohms per square; and

(ii) All conductors on surfaces, including dielectric surfaces that have been coated with conductive materials, are bonded to the launch vehicle by a resistance that is less than 10^5 ohms; or

(2) A launch operator demonstrates by test or analysis that electrostatic discharges on the surface of the launch vehicle caused by triboelectrification will not be hazardous to the launch vehicle or the spacecraft.

G417.25 Measurement of Cloud Radar Reflectivity, Computation of VAHIRR, and Measurement of Electric Field

(a) *Radar reflectivity measurement.* A launch operator who measures radar reflectivity to comply with this appendix must employ a meteorological radar and ensure that—

(1) The radar wavelength is greater than or equal to 5 cm;

(2) A reflectivity measurement is due to a meteorological target;

(3) The spatial accuracy and resolution of a reflectivity measurement is 1 kilometer or better;

(4) Any attenuation caused by intervening precipitation or by an accumulation of water or ice on the radome is less than or equal to 1 dBZ; and

(5) A reflectivity measurement contains no portion of the cone of silence above the radar antenna, nor any portion of any sector that is blocked out for payload safety reasons.

(b) *Computation of VAHIRR.* A launch operator who measures VAHIRR to comply with this appendix must ensure that—

(1) A digital signal processor provides radar reflectivity measurements on a three-dimensional Cartesian grid having a maximum grid-point-to-grid-point spacing of one kilometer in each of the three dimensions;

(2) The specified volume is the volume bounded in the horizontal by vertical, plane, perpendicular sides located 5.5 kilometers (3 nautical miles) north, east, south, and west of the point where VAHIRR is to be evaluated; on the bottom by the 0 degree Celsius level; and on the top by an altitude of 20 kilometers;

(3) Volume-averaged radar reflectivity is the arithmetic average of the radar reflectivity measurements in dBZ at grid points within the specified volume. A launch operator must include each grid point within the specified volume in the average if and only if that grid point has a radar reflectivity measurement equal to or greater than 0 dBZ. If fewer than 10% of the grid points in the specified volume have radar reflectivity measurements equal to or greater than 0 dBZ, then the volume-averaged radar reflectivity is either the maximum radar reflectivity measurement in the specified volume, or 0 dBZ, whichever is greater.

(4) Average cloud thickness is the difference in kilometers or thousands of feet between an average top and an average base of all clouds in the specified volume, computed as follows:

(i) The cloud base to be averaged is the higher, at each horizontal position, of either

(A) The 0 degree Celsius altitude, or

(B) The lowest altitude of all radar reflectivity measurements of 0 dBZ or greater.

(ii) The cloud top to be averaged is the highest altitude of all radar reflectivity measurements of 0 dBZ or greater at each horizontal position.

(iii) A launch operator must—

(A) Take the cloud base at any horizontal position as the altitude of the corresponding base grid point minus half of the grid-point vertical separation;

(B) Take the cloud top at that horizontal position as the altitude of the corresponding top grid point plus half of this vertical separation.

(5) All VAHIRR-evaluation points in the flight path itself are:

(i) Greater than a slant distance of 10 nautical miles from any radar reflectivity of 35 dBZ or greater at altitudes of 4 kilometers or greater above mean sea level; and

(ii) Greater than a slant distance of 10 nautical miles from any type of lightning that has occurred in the previous 5 minutes.

(iii) A launch operator need not apply paragraph (b)(5) of this section to VAHIRR evaluation points outside the flight path but within one nautical mile of the flight path.

(6) VAHIRR is the product, expressed in units of dBZ-km or dBZ-kft, of the volume-averaged radar reflectivity defined in paragraph (b)(3) of this section and the average cloud thickness defined in paragraph (b)(4) of this section in the specified volume defined in paragraph (b)(2) of this section.

(c) *Electric field measurement.* A launch operator who measures an electric field to comply with this appendix must—

(1) Employ a ground-based field mill,

(2) Use only the one-minute arithmetic average of the instantaneous readings from that field mill,

(3) Ensure that all field mills are calibrated so that the polarity of the electric field measurements is the same as the polarity of a voltage placed on a test plate above the sensor,

(4) Ensure that the altitude of the flight path of the launch vehicle is equal to or less than 20 kilometers (66 thousand feet) everywhere above a horizontal circle of 5 nautical miles centered on the field mill being used,

(5) Use only direct measurements from a field mill, and

(6) Not interpolate based on electric-field contours.

Issued in Washington, DC, on May 23, 2011.

J. Randolph Babbitt,

Administrator.

[FR Doc. 2011–14146 Filed 6–7–11; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF HOMELAND SECURITY

Coast Guard

33 CFR Part 165

[Docket No. USCG–2011–0265]

RIN 1625–AA00

Safety Zone; Michigan Bankers Association Fireworks, Lake Huron, Mackinac Island, MI

AGENCY: Coast Guard, DHS.

ACTION: Temporary final rule.

SUMMARY: The Coast Guard is establishing a temporary safety zone in the Captain of the Port Sault Sainte Marie zone. This zone is intended to restrict vessels from certain portions of water areas within Sector Sault Sainte Marie Captain of the Port zone, as defined by 33 CFR 3.45–45. This temporary safety zone is necessary to protect spectators and vessels from the hazards associated with fireworks displays.

DATES: This rule is effective from 9 p.m. to 11 p.m. on June 23, 2011.

ADDRESSES: Comments and material received from the public, as well as documents mentioned in this preamble as being available in the docket, are part of docket USCG–2011–0265 and are available online by going to *http://www.regulations.gov,* inserting USCG–2011–0265 in the "Keyword" box, and then clicking "Search". They are also available for inspection or copying at the Docket Management Facility (M–30), U.S. Department of Transportation, West Building Ground Floor, Room W12–140, 1200 New Jersey Avenue SE., Washington, DC 20590, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: If you have questions on this temporary rule, call or email BMC Gregory Ford, Prevention Department, Coast Guard, Sector Sault Sainte Marie, MI, telephone (906) 635–3222, email *Gregory.C.Ford@uscg.mil.* If you have questions on viewing or submitting material to the docket, call Renee V. Wright, Program Manager, Docket Operations, telephone 202–366–9826.

SUPPLEMENTARY INFORMATION:

Regulatory Information

On April 20, 2011, we published a notice of proposed rulemaking (NPRM) entitled Safety Zone; Michigan Bankers Association Fireworks, Lake Huron, Mackinac Island, Michigan, in the **Federal Register** (76 FR 22064). We received 0 public submissions commenting on the proposed rule. No public meeting was requested, and none was held.

Under 5 U.S.C. 553(d)(3), the Coast Guard finds that good cause exists for making this rule effective less than 30 days after publication in the **Federal Register**. Delaying the effective date of this rule would be impracticable and contrary to the public interest because it would inhibit the Coast Guard from ensuring the safety of vessels and the public during the fireworks display.

Background and Purpose

From June 21, 2011 through June 24, 2011, the Michigan Bankers Association's will celebrate its 125th anniversary. The celebration will take place on and around Mackinac Island. On the evening of June 23, 2011, the celebration will include a fireworks display to be launched from a water location. The Captain of the Port Sault Sainte Marie has determined that the fireworks event poses various hazards to the public, including obstructions to the navigable channel, explosive dangers associated with fireworks, and debris falling into the water. To minimize these and other hazards, this rule will establish a temporary safety zone around the fireworks display.

Discussion of Comments and Changes

The Coast Guard received 0 public submissions commenting on this rule.

Regulatory Analyses

We developed this rule after considering numerous statutes and executive orders related to rulemaking. Below we summarize our analyses based on 13 of these statutes or executive orders.

Regulatory Planning and Review

This rule is not a significant regulatory action under section 3(f) of Executive Order 12866, Regulatory Planning and Review, and does not require an assessment of potential costs and benefits under section 6(a)(3) of that Order. The Office of Management and Budget has not reviewed it under that Order. It is not "significant" under the regulatory policies and procedures of the Department of Homeland Security (DHS). We conclude that this rule is not a significant regulatory action because we anticipate that it will have minimal impact on the economy, will not interfere with other agencies, will not adversely alter the budget of any grant or loan recipients, and will not raise any novel legal or policy issues. The safety zone created by this rule will be relatively small and enforced for relatively short time. Also, the safety zone is designed to minimize its impact on navigable waters. Furthermore, the safety zone has been designed to allow vessels to transit around it. Thus, restrictions on vessel movement within that particular area are expected to be minimal. Under certain conditions, moreover, vessels may still transit through the safety zone when permitted by the Captain of the Port.

Small Entities

Under the Regulatory Flexibility Act (5 U.S.C. 601–612), we have considered whether this rule would have a significant economic impact on a substantial number of small entities. The term "small entities" comprises small businesses, not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000.

The Coast Guard certifies under 5 U.S.C. 605(b) that this rule will not have a significant economic impact on a substantial number of small entities. On April 20, 2011, the Coast Guard published a notice of proposed