[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 21

[Docket No. FAA-2018-0379]

Airworthiness Criteria: Special Class Airworthiness Criteria for the Yamaha Fazer R

AGENCY: Federal Aviation Administration (FAA), DOT

ACTION: Notice of proposed airworthiness criteria.

SUMMARY: The FAA announces the availability of and requests comments on proposed airworthiness criteria for an unmanned aircraft system, Yamaha Motor Corporation, U.S.A., model Fazer R. This document proposes policy for a special class of aircraft, to designate airworthiness criteria found by the FAA to provide an equivalent level of safety, for this proposed design, to existing standards.

DATES: Send comments on or before [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**].

ADDRESSES: Send comments identified by docket number FAA-2018-0379 using any of the following methods:

- Federal eRegulations Portal: Go to http://www.regulations.gov and follow the online instructions for sending your comments electronically.
- Mail: Send comments to Docket Operations, M-30, U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, DC, 20590-0001.

- Hand Delivery of Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, S.E., Washington, DC, between 9 a.m., and 5 p.m., Monday through Friday, except Federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

Privacy: The FAA will post all comments it receives, without change, to http://regulations.gov, including any personal information the commenter provides. Using the search function of the docket web site, anyone can find and read the electronic form of all comments received into any FAA docket, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the Federal Register published on April 11, 2000 (65 FR 19477-19478), as well as at http://DocketsInfo.dot.gov.

Docket: Background documents or comments received may be read at http://www.regulations.gov at any time. Follow the online instructions for accessing the docket or go to the 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: Mr. Quentin Coon, AIR-692, Federal Aviation Administration, Policy & Innovation Division, Small Airplane Standards Branch, Aircraft Certification Service, 901 Locust, Room 301, Kansas City, MO 64106, telephone (816) 329-4168, facsimile (816) 329-4090.

SUPPLEMENTARY INFORMATION:

Comments Invited

We invite interested people to take part in the development of these airworthiness criteria by sending written comments, data, or views. The most helpful comments reference a specific portion of the airworthiness criteria, explain the reason for any recommended change, and include supporting data. We ask that you send us two copies of written comments.

We will consider all comments received on or before the closing date for comments. We will consider comments filed late if it is possible to do so without incurring expense or delay. We may change these airworthiness criteria based on received comments.

Background

Yamaha Motor Corporation, U.S.A. (Yamaha) applied to the FAA on April 28, 2017 for special class type certification under Title 14, Code of Federal Regulations (14 CFR) 21.17(b) for the Fazer R Unmanned Aircraft System (UAS). The Fazer R UAS (Fazer R) consists of the Unmanned Aircraft (UA), flight transmitter ground control station, and payload spray system. The Fazer R is a vertical take-off UAS that is of the traditional main/tail rotor helicopter design. Its intended primary use is conducting crop-spraying operations in the agricultural industry.

The aircraft and payload spray system would weigh approximately 244 lbs with full fuel and oil tanks, and be able to carry a payload of approximately 105 lbs. The main rotor is just over nine feet in diameter, and the aircraft would be just over three feet high and 12 feet long with a carbon frame. The aircraft would be powered by a fuel-injected 2-cylinder engine running on regular gasoline. The aircraft would have a “Turn Assistance” function that enables automatic turning to facilitate back-and-forth agricultural operations.

The proposed policy was developed in order to establish performance-based airworthiness criteria appropriate for the Yamaha Fazer R.

Discussion

The FAA establishes airworthiness criteria to ensure the safe operation of aircraft in accordance with 49 U.S.C. §§ 44701(a) and 44704. The applicant has proposed a design with constraints upon its operations and an unusual design characteristic: the pilot is remotely located. The FAA proposes that existing airworthiness criteria, including Title 14 Code of Federal Regulations (14 CFR) parts 23 and 27, do not provide criteria appropriate to the proposed design.

The FAA proposes this aircraft is a "special class" under 14 CFR 21.17(b), and proposes that the following airworthiness criteria are appropriate for this aircraft and would provide an equivalent level of safety to existing airworthiness standards. These proposed airworthiness criteria differ from those in 14 CFR parts 23 and 27 due to the aircraft's design, which includes various constraints upon the aircraft's operation. These constraints include its relatively small size, lack of humans on board, and operations that would be limited to remote locations, low altitude, and visual range of a trained flight crew.

The FAA has reviewed the proposed design and assessed the potential risk to the National Aerospace System (NAS). The FAA took into consideration the size of the proposed aircraft, its maximum airspeed and altitude, and operational limitations such as where it would operate and whether it would operate out of sight of its operators. These factors allowed the FAA to estimate the kinetic energy of the proposed design when in operation, and the potential risk the aircraft could pose to other aircraft and people and property nearby. Using these types of parameters, the FAA developed airworthiness criteria appropriate for that risk to ensure the aircraft remains reliable, controllable, safe, and airworthy.

The particular airworthiness criteria proposed by this notice were selected for the following reasons:

UAS Concept of Operations: To assist the FAA in identifying and analyzing the risks and impacts associated with integrating the Fazer R proposed design into the NAS, the applicant would be required to submit a Concept of Operations (CONOPS). The CONOPS identifies the applicant's proposed operational concepts for this aircraft and would contain a description of the UAS and its operation.

UAS Means of Compliance: To address the risks associated with inadequate or incomplete showings of compliance to the performance-based criteria described in this notice, the proposed airworthiness criteria include a requirement that the applicant only utilize a means of compliance accepted by the FAA, in accordance with FAA Advisory Circular 23.2010-1.

UAS Operational Envelope and Limitations: In order to ensure the UAS is operated only in accordance with its type design, the applicant must define the operational envelope and proposed operational limitations. The applicant would be required to show that the UAS can be operated safely and reliably within the operational envelope and limitations, mitigating the hazards that could result from an unconstrained operating envelope.

UAS Instructions for Continued Airworthiness (ICA): To address the risks associated with degradation of the aircraft caused by age and use, and to ensure that the UAS can be maintained for safe operation, the applicant would be required to prepare Instructions for Continued Airworthiness for the UAS that are accepted by the FAA, in accordance with FAA Order 8110.54A. The proposed criteria are derived from 14 CFR parts 23 and 27, and past FAA practices, but are tailored for this proposed design.

UAS Flight Manual: To address the risks associated with improper operation of the UAS, such as flight above the approved operating altitude, at weights above maximum takeoff weight, and at speeds greater than the maximum allowed speed, the applicant would be required to provide a flight manual. The manual would be used to ensure that the flight crew operates the aircraft only within the proposed operational envelope and limitations.

UAS Flight Testing: To address the risks associated with inadequate design and integration, the applicant would be required to conduct flight testing to demonstrate adequate structure, system reliability, and proper function.

UAS Critical Parts: To ensure the continued airworthiness of the aircraft and address the risks of castrophic failure, which is a failure that causes a fatal injury or results in destruction of the UAS, the applicant would be required to identify those parts that could cause a catastrophic event upon failure. Those parts must be properly maintained to prevent a catastrophic failure.

UAS Controls: To address the risks associated with loss of control of the UAS caused by the failure or improper use of UAS controls, the applicant would be required to design controls that are adequate to safely and reliably control the UAS.

UAS Flight Termination System: To address the risks associated with uncontrolled flight and inadvertent or unsafe operation, the applicant would be required to provide a means to quickly and safely terminate the UAS flight.

UAS Engine and Engine Control System: To address the risks associated with failure or loss of control of the powerplant, the applicant would be required to design the engine and engine controls so that they are durable and reliable.

UAS Powerplant Installation: To address the risks associated with failure of the powerplant installation that includes each component necessary for propulsion or that affects propulsion

safety, the applicant would be required to design the powerplant installation to ensure its continued safe operation.

UAS Systems and Equipment: To address the risks associated with the failure or malfunction of electric and mechanical systems and equipment, the applicant would be required to design and install the systems and equipment to perform safely and reliably their intended function when considered separately and in relation to other systems.

UAS Communication: To address the risks associated with loss of communication between the flight crew members and between the flight crew and the UA, the applicant would be required to provide an FAA approved means that allows for all communication necessary to safely operate the UA.

UAS Interference from External Sources: To address the risks associated with cyber threats and system failures or malfunctions, the applicant would be required to design the UAS' electronic systems and networks to protect against and minimize the effects of intentional and unintentional external interference.

UAS Interference with Other Aircraft or Obstacles: To address the risks associated with collisions with obstacles and other aircraft, the applicant would be required to use an FAA accepted means of compliance showing how the UAS will remain well clear of obstacles and other aircraft so as to avoid the risk of collision.

Operational Considerations

The following operational considerations were derived from the applicant's CONOPS, which helped drive the development of these proposed airworthiness criteria. The aircraft would:

1. Be primarily used for agricultural use to include spraying, sensing, and imaging.
2. Operate in remote or sparsely populated areas.

3. Not operate over people and occupied vehicles on roads and highways.

4. Operate at 400 feet above ground level (AGL) or lower.

5. Operate at a maximum altitude of 6,500 feet above mean sea level (MSL).

6. Be operated within Visual Line of Sight (VLOS) as defined in 14 CFR part 107.31, Visual line-of-sight aircraft operation.

7. Be operated by a minimum flight crew consisting of one pilot-in-command (PIC) and one visual observer.

8. Be operated by a flight crew that is appropriately qualified and trained.

9. Be operated by a minimum flight crew that would operate only one UAS at any time.

10. Be operated by a flight crew that has successfully completed required flight crew training.

11. Be maintained by persons who hold required FAA maintenance certificates or work according to an FAA approved maintenance program.

12. Be maintained by persons who have completed required maintenance training.

13. Be equipped with caution and alerting annunciation that is visible to the PIC and visual observer during flight.

14. Remain within Radio Line-of-Sight (RLOS) of the control station. RLOS is the straight and unobstructed path between the transmitting and receiving antennas.

15. Electronically communicate between the UA and the ground control station only within frequencies approved by the Federal Communications Commission (FCC).

16. Operate in Class G airspace unless specifically authorized by the FAA.

17. Operate subject to minimum setback distances that define how far people must be from the UA, the control station, and the operating zone when the UA is operating.

18. Operate within specific meteorological conditions that define permissible wind speeds, turbulence, visibility, outside air temperature, or other parameters as identified. The UAS would not operate in icing conditions, in accordance with 14 CFR 91.527.

19. Operate in day Visual Meteorological Conditions (VMC).

NOTE: A change to the CONOPS may require a change to the airworthiness criteria.

Proposed Airworthiness Criteria

The FAA proposes to establish, as a matter of policy, the following airworthiness criteria for type certification of the Yamaha Fazer R. The FAA proposes that compliance with the following would appropriately mitigate the risks associated with the proposed design and Concept of Operations (CONOPS) and would provide an equivalent level of safety to existing rules:

UAS Concept of Operations: The applicant must define and submit to the FAA a (CONOPS) proposal describing the intended UAS operation in the National Airspace System (NAS).

UAS Accepted Means of Compliance:

1. An applicant must comply with these airworthiness criteria using a means of compliance, which may include consensus standards, accepted by the FAA.

2. An applicant requesting acceptance of a means of compliance must provide the means of compliance to the FAA in a form and manner acceptable to the FAA.

UAS Operational Envelope and Limitations: The operational envelope and operational limitations must be defined:

1. The UAS must be shown to perform as intended within the defined operational envelope and operational limitations.

2. The UAS must be consistently and predictably controllable and maneuverable within the operating envelope, including:

a) At all loading conditions for which certification is requested;

b) During all phases of flight; and

c) During configuration changes.

UAS Instructions for Continued Airworthiness: The applicant must prepare Instructions for Continued Airworthiness (ICA) for the UAS that are acceptable to the FAA. The ICA may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first UAS or issuance of a standard certificate of airworthiness, whichever occurs later.

The ICA must contain a section titled Airworthiness Limitations that is segregated and clearly distinguishable from the rest of the document. This section must set forth each mandatory replacement time, structural inspection interval, and related structural inspection procedure required for type certification. If the ICA consist of multiple documents, the section required by this paragraph must be included in the principal manual. This section must contain a legible statement in a prominent location that reads "The Airworthiness Limitations section is FAA approved and specifies maintenance conducted under §§ 43.16 and 91.403 of Title 14 of the Code of Federal Regulations unless an alternative program has been FAA approved."

UAS Flight Manual: The applicant must provide a UAS Flight Manual with each UAS. The UAS Flight Manual must contain the following information—

a) UAS operating limitations;

b) UAS normal and emergency operating procedures;

c) Performance information;

d) Loading information; and

e) Other information that is necessary for safe operation because of design, operating, or handling characteristics.

UAS Flight Testing: The UAS must successfully complete at least 150 hours of flight testing to determine whether there is reasonable assurance that the UAS, its components, its equipment, and structures are adequate, reliable, and function properly. The testing must consist of:

1. At least 50 hours with the Unmanned Aircraft (UA) at 5 percent over maximum weight at critical weight, altitude, and temperature; and

2. At least 100 hours in normal operations.

UAS Critical Parts: A critical part is a part, the failure of which could have a catastrophic effect upon the UAS. If the type design includes critical parts, a critical parts list must be established.

The applicant must develop and define inspections or other procedures to prevent failures due to degradation of critical parts. Each of these inspections or procedures must be included in the Airworthiness Limitations Section of the ICA.

UAS Controls:

1. **Flight Controls:** The applicant must design the flight control systems and control station to:

a) Operate easily, smoothly, and positively enough to allow proper performance of their functions, and

b) Protect against likely hazards.

2. **Flight Crew Interface:** The control station must be designed to allow the flight crew to perform their duties and to perform any maneuvers within the operating envelope of the UAS,

without excessive concentration, skill, alertness, or fatigue considering the intended operating conditions for the control station.

3. **Equipment:** The applicant must define and install necessary equipment so the flight crew can monitor and perform defined tasks associated with the intended functions of the systems and equipment.

4. **Flight Crew Error:** The UAS must be designed to minimize flight crew errors which could result in additional hazards.

UAS Flight Termination System:

1. There must be a means for the flight crew to quickly and safely terminate the UA flight.

2. The UAS must have a means to safely terminate the UA flight when safe operation cannot continue or be maintained.

3. There must be means to prevent inadvertent operation of the flight termination system.

UAS Engine and Engine Control System:

1. The UAS Engine and Engine Control System includes each component necessary for propulsion or which affects propulsion safety.

2. The UAS Engine and Engine Control System installation must be designed, constructed, installed, and maintained to ensure its continued safe operation within the operational envelope between normal inspections and overhauls.

3. The UAS Engine Control System including any Engine Control Unit (ECU) software or electronic hardware must be designed and developed using methods accepted by the FAA.

4. The applicant must identify the UAS Engine and Engine Control System failure modes and effects that may result in a catastrophic condition to the UAS. The applicant must mitigate each hazard to a level acceptable to the FAA.

5. The UAS Engine and Engine Control System operability, durability and reliability must be demonstrated.

UAS Powerplant Installation:

1. The powerplant installation includes each part of the UAS (other than the main and auxiliary rotor structures) that—

a) Is necessary for propulsion;

b) Affects the control of the major propulsive units; or

c) Affects the safety of the major propulsive units between normal inspections or overhauls.

2. Each component of the powerplant installation must be constructed, arranged, and installed to ensure its continued safe operation between normal inspections or overhauls for the range of temperature and altitude for which approval is requested.

UAS Systems and Equipment: This requirement applies to the UAS unless another requirement has been imposed for a specific piece of equipment, system, or systems. The UAS systems and equipment, including any software or electronic hardware, must be designed and developed using methods accepted by the FAA.

1. The systems and equipment required for a UAS to operate safely in the kinds of operations for which certification is requested must be designed and installed to perform their intended function throughout the operating and environmental limits for which the UAS is certificated.

2. All systems and equipment not covered by paragraph 1 of this section, considered separately and in relation to other systems, must be designed and installed so their operation or failure, does not have an adverse effect on the UAS.

UAS Communication:

1. The applicant must define the type, methods, and operational limits of communication, including the mitigation of any hazard created by any loss of communication between the flight crew and between the flight crew and the UAS.

2. A means must be provided to allow for all communication necessary to safely operate the UA.

UAS Interference from External Sources: The design must minimize the risks associated with interference to UAS electronic systems and networks from external sources.

UAS Interference with Other Aircraft or Obstacles: The UAS must have a means to remain well clear of obstacles and other aircraft for its intended operation and airspace to avoid the risk of collision.

NOTE: The FAA may propose amending this airworthiness criteria, or propose additional operational criteria, prior to approval of the type design.

Issued in Kansas City, Missouri on April 23, 2018.

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Aircraft Certification Service
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