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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. CE162; Special Conditions No. 23–110–SC]

Special Conditions: Ayres Corporation Model LM 200, ''Loadmaster'' Propulsion

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions.

SUMMARY: These special conditions are issued for the Ayres Corporation Model LM 200 airplane. This airplane will have a novel or unusual design feature(s) associated with a 14 CFR Part 23 commuter category airplane which incorporates a propulsion system that consists of a twin engine powerplant that drives a single propeller through a combining gearbox. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

EFFECTIVE DATE: November 5, 2001.

FOR FURTHER INFORMATION CONTACT: Mr. Brian Hancock, Federal Aviation Administration, Aircraft Certification Service, Small Airplane Directorate, ACE–112, 901 Locust, Room 301, Kansas City, Missouri 64106; 816–329–4143, fax 816–329–4090.

SUPPLEMENTARY INFORMATION:

Background

On April 16, 1996, Ayres Corporation applied for a type certificate for their new Model LM 200 and reapplied in May 1997 adding passenger and combi configurations. The Model LM 200 airplane will have a 19,000 pound maximum takeoff weight with a payload capacity of about 7,500 pounds. The propulsion system will consist of a Light Helicopter Turbine Engine Company (LHTEC) CTP800–4T powerplant driving a single Hamilton Standard Model 568F–11, 12.9-foot diameter, propeller. The powerplant consists of two LHTEC CTS800 derivative turboprop engines plus a combining gearbox. The powerplant will be certified to 14 CFR part 33 and identified as a twin power section turboprop assembly. The two turboprop engines will be certified as part of the twin power section turboprop assembly (powerplant) and will not have separate individual type certificates. The airplane will be of conventional, semi-monocoque, aluminum construction with a high cantilever wing, fixed gear, mechanical and electro-mechanical controls and will be unpressurized. Certification will include flight into known icing and single pilot, IFR operations. Three interior configurations have been proposed: a cargo configuration (bulk or containerized cargo), a nine-passenger configuration, and ''combi'' (combination of up to nine passengers and cargo).

Type Certification Basis

Under the provisions of 14 CFR 17, Ayres Corporation must show that the Model LM 200 meets the applicable provisions of part 23 as amended by Amendments 23–1 through Amendment 53, effective April 30, 1998.

If the Administrator finds that the applicable airworthiness regulations (i.e., part 23) do not contain adequate or appropriate safety standards for the Model LM 200 because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

In addition to the applicable airworthiness regulations and special conditions, the Model LM 200 must comply with the part 23 fuel vent and exhaust emission requirements of 14 CFR part 34 and the part 23 noise certification requirements of 14 CFR part 36. Also, the FAA must issue a finding of regulatory adequacy pursuant to § 611 of Public Law 92–574, the ''Noise Control Act of 1972.''

Special conditions, as appropriate, as defined in § 11.19, are issued in accordance with § 11.38, and become part of the type certification basis in accordance with § 21.17(a)(2).

Special conditions are initially applicable to the model for which they are issued. Should the type certificate for that model be amended later to include any other model that incorporates the same novel or unusual design feature, the special conditions would also apply to the other model under the provisions of § 21.101(a)(1).

Novel or Unusual Design Features

The following definitions will apply to the Ayres Model LM 200 airplane design:

Powerplant—The Light Helicopter Turbine Engine Company (LHTEC) Model CTP800–4T powerplant, consists of two CTS800 derivative turboprop engines, a GKN Westland combining gearbox (CGB), and the engine assembly support structure. The powerplant is capable of providing 2,700 shp combined output power at takeoff and 1,350 shp with one engine inoperative. The CTP800–4T powerplant will obtain a part 33 type certificate identifying the powerplant as a ''twin power section turboprop assembly.''

Engine—An LHTEC CTS800 derivative, non-regenerative, front drive, free turbine power section, which includes compressor, combustor, turbine and accessories group. Each engine of the CTP800–4T is separately controlled by a fully redundant full authority digital electronic control (FADEC). The two engines will only be certified as part of the CTP800–4T powerplant. The CTP800–4T type certificate data sheet will include ratings and limitations for each engine in addition to that of the powerplant.

Engine Assembly Support Structure—The supporting structure that connects the two engines to the CGB. This structure will be type certificated as part of the CTP800–4T powerplant under part 33.

Propulsion System Unit (PSU)—The Model LM 200 airplane PSU consists of the powerplant plus the airframe mounted non-integrated lubrication system components, which include the CGB oil tank and CGB/engine oil cooler, as well as a single Hamilton Sundstrand Model 568F–11 propeller system.

Combining Gearbox (CGB)—All components necessary to transmit power from the two engines to the propeller. This includes couplings, supporting bearings for shafts, brake assemblies, clutches, gearboxes, transmissions, any attached accessory pads or drives, and any cooling fans that are attached to, or mounted on, the CGB. The CGB will be type certificated as part of the CTP800–4T powerplant under part 33.

Multi-Engine—For the Model LM 200 and its powerplant configuration, ''multi-engine'' refers to the twin engine capability and ratings of the CTP800–4T powerplant in regard to type certification in the commuter category and flight operation.

One Engine Inoperative (OEI)—For the LM 200 airplane, ''one engine inoperative'' refers to a condition in which one engine of the CTP800–4T powerplant is not operational and the operation of the propeller is unchanged.

Part 23 does not contain adequate or appropriate requirements for the Ayres Model LM 200 powerplant installation of twin engines driving a single propeller through a combining gearbox. Issues include preventing unbalance damage to either the engines or the powerplant mounting system, or both, resulting from any engine or propeller single failure or probable combination of failures and the capability to continue safe flight to a landing. The propeller and other non-redundant components must be of sufficient durability to minimize any possibility of a failure that could have catastrophic implications to either the airplane or its propulsion system, or both.

Elements of these proposed special conditions have been developed to supplement part 23 standards that are considered inadequate to address the Model LM 200 airplane design, namely §§ 23.53, 23.67, 23.69, 23.75, 23.77, 23.903, 23.1191, 23.1305, 23.1583, 23.1585 and 23.1587.

Special conditions addressing the engine isolation requirements of § 23.903 were not included as the current rule is considered adequate. However, since the design of the multi-engine, single propeller Model LM 200 airplane will be significantly affected by this rule, the following comments are provided. Section 23.903(c) states, ''The powerplants must be arranged and isolated from each other to allow operation, in at least one configuration, so that the failure or malfunction of any engine, or the failure or malfunction (including destruction by fire in the engine compartment) of any system that can affect an engine (other than a fuel tank if only one fuel tank is installed), will not: (1) prevent the continued safe operation of the remaining engines; or (2) require immediate action by any crew member for continued safe operation of the remaining engines.'' This is a fail-safe requirement in that it takes advantage of the redundancy provided by having multiple engines that are physically separated from each other, which is intended to ensure that no single failure affecting one engine will result in the loss of the airplane (also reference § 23.903(b)(1)). In conventional twin turboprop airplanes, this isolation is, in part, provided by the inherent separation of having each engine mounted on opposite sides of the airplane driving its own propeller. Installation of the engines on either side of the airplane automatically provides a degree of separation of critical systems, such as the electrical and fuel systems, and minimizes the effect of high vibration, rotor burst failures, and engine case burn-through from the opposite engine. This separation aids in preventing any single failure from jeopardizing continued safe operation of the airplane. In contrast, the nearness of the engines to each other driving a combining gearbox with a single propeller in the Model LM 200 airplane arrangement is inherently less isolated from certain types of failure modes. As a result, many failure modes that do not pose a significant hazard on conventional multi-engine airplanes could threaten continued safe operation of the Model LM 200 airplane unless specific additional precautions are taken to prevent hazardous secondary effects.

The FAA has reviewed the part 23 standards and identified that §§ 23.53(c), 23.67(c), 23.69, 23.75, and 23.77 are inadequate to address the effects of propeller control system failure modes in a manner consistent with how these sections address specific engine failure conditions. Sections 23.1191(a) and 23.1191(b) do not adequately define the locations of firewalls needed to isolate the engines and CGB of the PSU. Additionally, the FAA has identified that § 23.1305(c) is inadequate because it does not recognize the uniqueness of the Model LM 200 PSU. Furthermore, the FAA has identified that §§ 23.1583(b), 23.1585(c), and 23.1587(a) do not recognize a propeller system installation independent from either engine. Elements of these special conditions have been developed to ensure that these unique aspects of the Model LM 200 airplane are addressed in a manner equivalent to that established by part 23 standards. The FAA's analysis and derivation of each of the special condition requirements is discussed in the ''Description of Requirements'' section below.

Description of Requirements

The Model LM 200 will incorporate the following novel or unusual design features:

(a) PSU Reliability

In order to define special conditions with the goal of establishing a safety level acceptable for certification as a limited commuter category airplane, the unique configuration of the Model LM 200 single propeller, twin engine design must be addressed. The Model LM 200 PSU design has eliminated as many single point failures as feasible for this type of configuration; however, certification criteria for the remaining single point failures unique to this configuration must be considered. A System Safety Analysis of the PSU is proposed that will identify and classify all possible failures that could be hazardous or catastrophic to the Model LM 200. The System Safety Analysis will consider such factors as non-redundancy, quality of manufacture and maintenance for continued airworthiness, as well as anticipated human errors, and it will highlight critical procedures that should be considered as required inspection items. Parts identified in the PSU System Safety Analysis whose failure results in a hazardous or catastrophic event will require control via a Critical Parts Plan. Furthermore, critical failure modes that could result in hazardous or catastrophic events should be addressed with appropriate design features to mitigate the potential results of such events.

The critical parts plan should be modeled after plans required by 14 CFR part 29, § 29.602, and related advisory material in Advisory Circular 29–2C for critical rotorcraft components. In addition, best industry practices shall be utilized in the definition and implementation of these critical parts. This plan will draw the attention of the personnel involved in the design, manufacture, maintenance, and overhaul of a critical part to the special nature of the part. The plan should define the details of relevant special instructions to be included in the Instructions for Continued Airworthiness. The Instructions for Continued Airworthiness, required by § 23.1529, should contain appropriate life limits, mandatory overhaul intervals, enhanced inspection limits, periodic ultrasonic (or equivalent) inspections, enhanced annual inspections, and conservative damage limits for return to service and repair for the critical parts identified in accordance with these proposed special conditions.

A means of annunciating hazardous and catastrophic failures to the cockpit should be provided if they are not immediately identifiable to the flight crew. Appropriate inspection intervals must be proposed to address any possible latent failures, which may go undetected.

For those failure modes unique to the non-conventional Model LM 200 design that have a fail-safe designed backup, either an acceptable test or analysis, or both, must address worst case conditions to substantiate the design. Methods to periodically check the backup system shall also be provided, as appropriate. In addition, a means of annunciating failure of the primary to the cockpit should be provided if it is not immediately identifiable to the flight crew. Appropriate inspection intervals must be proposed to address any possible latent failures, which may go undetected.

(b) Powerplant Requirements

Although rare, high-energy rotor unbalances due to high energy rotating machinery failures, such as a rim separation, can occur in-flight. They are typically followed quickly by either an in-flight shutdown or a pilot-commanded engine shutdown. The proposed special conditions address this short duration following a rotor failure by requiring that any high-energy vibration not affect the airworthiness of the operating engine. These vibrations could otherwise affect the operating engine in areas such as rotation (rubs), compressor surge or stall, damage to engine controls, accessories, mechanical, lubrication, fuel systems, and possible engine misalignment with respect to the gearbox. The magnitudes, frequency, and duration of such a vibration should be included in the powerplant installation manual. In addition, the vibration should not affect the structural integrity of the mounting system of either engine or the combining gearbox.

The CGB includes all parts necessary to transmit power from the engines to the propeller shaft. This includes couplings, supporting bearings for shafts, brake assemblies, clutches, gearboxes, transmissions, any attached accessory pads or drives, and any cooling fans that are attached to, or mounted on, the gearbox. The CGB for this multi-engine installation must be designed with a ''continue to run'' philosophy. This means that it must be able to power the propeller after failure of one engine or failure in one side of the CGB drive system, including any gear, bearing, or element expected to fail. Common failures, such as oil pressure loss or gear tooth failure, in the CGB must not compromise power output from the propulsion system.

Current engine certification regulations do not adequately address the requirements of a single combining gearbox; therefore, in addition to the engine requirements of § 23.903, the CGB will be required to complete a 200 hour endurance test that is patterned after the rotor drive system requirements of § 29.923. The endurance test is intended to exercise integration of the engines, combining gearbox, and loading characteristics of the intended propeller. Additional testing patterned after § 29.927 will address the torque and speed limits. The CGB design should contain features that include automatic disengagement of any failed engine (reference § 29.917(c)(3)), independent lubrication systems (reference § 29.1027), indicators to alert the pilot of lubrication system failure, and the capability to continue safe flight to a landing for a minimum of one-hour following pilot notification of CGB primary lubrication system failure.

The requirement for continued safe flight to a landing for a minimum of one-hour following pilot notification of CGB primary lubrication system failure stems from similarities between the Model LM 200 propulsion system and that of a typical multi-engine rotorcraft. Transport category A rotorcraft must be capable of sustaining flight for 30-minutes after the crew is notified of a drive system lubrication system failure or loss of lubricant, § 29.927(c). A rotorcraft may autorotate to a small landing area and, therefore, may find a safe landing area much sooner than a 19,000 pound airplane. For this reason, the FAA is similarly proposing that the Model LM 200 demonstrate its ability to sustain flight for one-hour, in accordance with AFM instructions for an emergency landing, after crew notification of a CGB primary lubrication system failure.

The critical parts of the CGB must also undergo a fatigue evaluation patterned after the structural requirements of § 29.571 for transport rotorcraft.

The Initial Maintenance Interval will be established during the powerplant certification testing, per § 33.90.

A rotor disc fragment should not be allowed to compromise the structural integrity of the powerplant or engine mounts. Loss of the structural integrity of the powerplant mount would be considered catastrophic for the Model LM 200 design. The powerplant and engine mount principal structural elements should be fail-safe if they could be severed during an uncontained engine failure. All other principal structural elements of the powerplant and engine mounting system should be either fail-safe or damage tolerant.

(c) Propeller Installation

With a multi-engine, single propeller installation, the non-redundancy of the propeller system components from the propeller shaft forward becomes quite significant. In the case of the Model LM 200, Ayres Corporation must design against the possibility of a propeller-related failure that could result in catastrophic loss of the airplane. To accomplish this task, Ayres Corporation must substantiate the structural integrity of their design and must establish a critical parts program and a continued airworthiness maintenance and inspection program that ensures that the propeller is maintained in an acceptable manner.

The Model LM 200 airplane's single propeller system must be installed and maintained in such a manner as to substantially reduce or eliminate the occurrence of failures that would preclude continued safe flight and landing. To ensure the propeller installation, production, and maintenance programs are sufficient to achieve a high level of reliability, these proposed special conditions include a 2,500 cycle validation test based on enhanced requirements of § 35.41(c). The 2,500 cycles correspond to the FAA's estimated annual usage for a turboprop airplane in commercial service. An airplane cycle includes idle, takeoff, climb, cruise, and descent. The test must utilize production parts installed on the powerplant and should include a wide range of ambient and wind conditions, several full stops, and validation of scheduled and unscheduled maintenance practices. The purpose of this test is to evaluate the system for service wear conditions and start/stop cycles. It is not intended to test the propeller vibratory loads. This evaluation may be accomplished on the airplane in a combination of ground and flight cycles or on a ground test facility. If the testing is accomplished on a ground test facility, the test configuration must include the PSU and all sufficient airframe interfacing system hardware to simulate the actual airplane installation and operation.

On a conventional multi-engine airplane, the flight crew will secure an engine and feather the propeller to minimize effects of propeller imbalance. Propeller imbalance could be caused by blade failures or by propeller system failures such as loss of a de-icing boot, malfunction of a de-icing boot in icing conditions, an oil leak into a blade butt, asymmetric blade pitch, or a failure in a counterweight attachment. The Model LM 200 airplane design does not provide any means to reduce the vibration produced by an unbalanced propeller. Therefore, these proposed special conditions require that the engines, CGB, powerplant and engine mounting system, primary airframe structure, and critical systems be designed to function safely in the high vibration environment generated by these less severe propeller failures. Ayres Corporation must specify the maximum allowable propeller unbalance. This is the maximum unbalance that will not cause damage to the engines, powerplant and engine mounting system, CGB, primary airframe structure, or to any other critical equipment that would jeopardize the continued safe flight and landing of the airplane. The vibration level caused by this unbalance must not jeopardize the flight crew's ability to continue to operate the airplane in a safe manner. Any part (or parts) whose failure (or probable combination of failures) would result in a propeller unbalance greater than the defined maximum would also be classified as a critical part.

It should be shown by a combination of tests and analyses that the airplane is capable of continued safe flight and landing with the maximum propeller unbalance, which includes collateral damage caused by the unbalance event.

During continued operation for one hour with the declared maximum unbalance, the evaluation should show that the induced vibrations will not cause damage either to the primary structure of the airplane or to critical equipment that would jeopardize continued safe flight and landing. The degree of flight deck vibration should not prevent the flight crew from operating the airplane in a safe manner. This includes the ability to read and accomplish checklist procedures. This evaluation should consider the effects on continued safe flight and landing from the possible damage to primary structure, which includes but is not limited to engine mounts, inlets, nacelles, wing, and flight control surfaces. Consideration should also be given to the effects of vibratory loads on critical equipment (including connectors) mounted on the engine or airframe.

In the unique design of the Model LM 200 CGB, the FAA understands that reverse rotation of the propeller on the ground would engage the sprag clutch. In turn, this would drive both engines without lubrication of the engine bearings or gearbox and cause possible damage to those elements; therefore, a means must be provided to prevent any adverse effects resulting from propeller ''wind-milling'' on the ground.

The Hamilton Sundstrand Model 586F–11 propeller meets special conditions imposed during the propeller type certification program (Docket Nos. 94–ANE–60 and 94–ANE–61). The propeller special conditions addressed electronic propeller and pitch control systems, a four-pound bird strike, lightning strike and fatigue. If the propeller had not been required to meet those conditions during its type certification program, the FAA would have required similar measures in these Model LM 200 special conditions since the propeller is an especially critical component on this airplane. To meet the airplane requirements for the Model LM 200, the Instructions for Continued Airworthiness may need to be modified.

(d) Propeller Control System

For this propeller control system, no probable multiple failures were identified that create a hazardous condition; therefore, these special conditions were written to consider single point failures in the primary propeller control system only.

These proposed special conditions require the propeller control system to be independent of the engines such that a failure of any engine or the engine's control system will not result in failure or inability to control the propeller.

Ayres Corporation plans to address these special conditions by providing a mechanical high pitch stop, which would be set to a ''get home'' pitch position, thereby preventing the propeller blades from rotating to a feather pitch position when oil pressure is lost in the propeller control system. This would allow the propeller to continue to produce a sufficient level of thrust as a fixed pitch propeller.

In the event the propeller undergoes an uncommanded pitch change, these proposed special conditions require that the Model LM 200 airplane not be placed in an unsafe condition. They also require that an indication of the failure be provided to the flight crew.

(e) PSU Instrumentation

On a conventional multi-engine airplane, the pilot has positive indication of an inoperative engine created by the asymmetric thrust condition. The airplane will not yaw when an engine or a portion of the CGB fails because of the centerline thrust of the Model LM 200 airplane propulsion system installation. The flight crew will have to rely on other means to determine which engine or CGB element has failed in order to secure the correct engine. Therefore, these proposed special conditions require that a clear indication of an inoperative engine or a failed portion of the CGB must be provided. This is necessary to preclude confusion by the flight crew in reacting to the failure and when taking appropriate action to secure the airplane in a safe condition for continued flight.

Section 23.1305 requires instruments for the fuel system, engine oil system, fire protection system, and propeller control system. This rule is intended for powerplants consisting of a single engine, gearbox, and propeller. To protect the portions of the PSU that are independent of the engines, additional instrumentation, including gearbox oil pressure, oil quantity, oil temperature, propeller speed, propeller blade angle, engine torque, and chip detection, are required.

(f) Fire Protection, Extinguishing, and Ventilation Systems

On a conventional twin engine airplane, the engines are sufficiently separated to essentially eliminate the possibility of a fire spreading from one engine to another. In the Model LM 200, the engines are in close proximity, separated only by a ballistic shield and firewall. The fire protection system of the Model LM 200 airplane must include features to isolate each fire zone from any other zone and the airplane in order to maintain isolation of the engines and CGB during a fire. Therefore, these proposed special conditions mandate that the firewall required per § 23.1191 be extended to provide firewall isolation between either engine and the CGB. Furthermore, if the potential for fire exists in the CGB compartment, these special conditions require that enough fire-extinguishing agents be available to supply the CGB compartment and one engine compartment with the CGB on a dedicated system. These proposed special conditions require that heat radiating from a fire originating in any fire zone must not affect components in adjacent compartments in such a way as to endanger the airplane. If the potential for fire does not exist within the CGB compartment, this must be substantiated by analysis.

Each fire zone should be ventilated to prevent the accumulation of flammable vapors. In addition, it must be designed such that it will not allow entry of flammable fluids, vapors, or flames from other fire zones. It should also be designed such that it does not create an additional fire hazard from the discharge vapors.

(g) Airplane Performance

Propeller control system failures may not be catastrophic in a conventional commuter category airplane; however, these types of failures should be demonstrated as not being catastrophic for the Model LM 200. To ensure a comparable level of safety to conventional commuter category airplanes in the event of a propeller control system failure, these proposed special conditions require that the Model LM 200 propulsion system be designed such that the airplane meets the one-engine-inoperative performance requirements of §§ 23.53, 23.67, 23.69, and 23.75 with the propeller control system failed placing the propeller in the most critical thrust producing condition with both engines operating normally.

(h) Airplane Flight Manual

In accordance with the exemption to § 23.3(d), the limitations section of the Airplane Flight Manual will limit the airplane to a maximum of nine passengers.

Sections 23.1583, 23.1585 and 23.1587 require pertinent information to be included in the Airplane Flight Manual. These rules are not adequate to address critical propeller failures or propeller control system failures on the Model LM 200 airplane. As a result, these proposed special conditions require that the critical procedures and information required by §§ 23.1583(b), 23.1583(c), 23.1585(a), 23.1585(c) and 23.1587(d) include consideration of these critical propeller failures or propeller control system failures in order to ensure a high level of safety for this airplane.

(i) Suction Defueling

The Model LM 200 design includes a suction defuel capability not envisaged when part 23 was developed. It is understood that suction defuel is a common feature in part 25 airplanes. The Model LM 200 airplane will have pressure fuel and defuel capability. Pressure defueling essentially entails reversing the pumps on the fueling vehicle and ''evacuating'' fuel under vacuum from the airplane through the servicing port. Section 23.979 addresses pressure fueling but not suction defueling. In addition to meeting the general requirements for part 23 fuel systems, any suction defueling components must also function as intended.

(j) FADEC Installation

Each of the engines will be controlled by a fully redundant full authority digital electronic control (FADEC). Each engine will utilize two single channel FADEC's, which yields a total of four to service the PSU. Each FADEC is identical and contains engine and propeller control capability. However, only two of the four units are wired to control the propeller. Cross-FADEC communication provides automatic enabling of the automatic power reserve in case of a single engine failure during takeoff. During normal operation, one FADEC of each engine controls that engine's operation while the second FADEC remains in hot standby mode with the outputs deactivated and waiting to assume control. If the controlling unit fails, the unit in standby mode should instantly assume control of the engine and propeller (if applicable) without noticeable discontinuity.

As the sole means of controlling the engine and the primary means of controlling the propeller on the Model LM 200 airplane, the FADEC installation must comply with the system installation requirements of § 23.1309. While this rule was not developed to address the specifics of a FADEC installation, this requirement is consistent with the rule's intent to cover all complex electronic systems that perform critical functions.

Applicability

As discussed above, these special conditions are applicable to the Model LM 200. Should Ayres Corporation apply at a later date for a change to the type certificate to include another model incorporating the same novel or unusual design feature, the special conditions would apply to that model as well under the provisions of § 21.101(a)(1).

Discussion of Comments

A notice of proposed special conditions, Notice No. 23–00–03–SC, for the Ayres Corporation Model LM 200 ''Loadmaster'' airplane was published on August 14, 2000 (65 FR 49513). Where comments arrived without a recommended change to the special conditions, those comments are not addressed here. It should be noted that the FAA does not assume that the airplane will maintain the same level of operation and certitude as a Commuter Category airplane. Also, non-redundant propulsion systems are addressed separately from the proposed special conditions (an exemption to 14 CFR part 23, § 23.3(d), the multi-engine requirement, was needed).

Comments received with a recommendation have been resolved and the special conditions are adopted with the following revisions:

1. A helicopter engine company suggested we use ''twin power section turboprop'' instead of ''twin power section turboshaft'' under the background, the novel or unusual design features, the powerplant definition, the proposed special conditions, and the definitions.

Resolution: Adopted. ''Twin power section turboshaft'' has been changed to ''twin power section turboprop.''

2. The same commenter recommends we revise the definition of ''combi'' configuration in the background section by adding the phrase ''up to nine passengers'' to clarify it.

Resolution: Adopted. The comment further clarifies that the LM 200 will be limited by the type certificate to a maximum of nine passengers in any configuration.

3. One commenter recommended that we clarify that the one-hour continue-to-run capability of the combining gearbox is after a failure of the primary lubrication system. A double failure that also fails the emergency lubrication system may not provide this capability. Therefore, the commenter suggests rewording paragraphs (b) and 2(b)(3)(vi).

Resolution: The intent of the special condition was not to address the primary system failures only but single failures of the entire CGB lubrication system. A lubrication system failure that would not affect the ability for continued operation, as with the emergency lubrication system, indicated by the commenter, would meet the requirement. In these special conditions the words ''a failure'' regard multiple, independent failures and cascading failures. Multiple, independent failures need not be addressed. However, cascading failures resulting from a single failure would still need to be addressed.

The confusion appears to be caused by reference to ''primary lubrication system'' in section (b) ''Powerplant Requirements''. All other discussions refer to it as the ''CGB lubrication system''. Therefore, ''primary'' in section (b) will be replaced with ''CGB'' for consistency with the rest of the proposed Special Conditions.

4. LHTEC indicated that the entire Part 33 CTP800–4T powerplant, including the combining gearbox (CGB), will undergo a 1500 hour Time to Initial Maintenance Inspection Interval FAA certification test, per 14 CFR part 33, § 33.90. They believe, since the CGB is a component of the FAR 33 powerplant, this test should be used to establish the CGB inspection interval rather than the special condition 200 hour endurance test. Therefore, they recommend revising paragraphs (b) and paragraph 2.

Resolution: Not adopted. As stated on page 49516, Description of Proposed Requirements, paragraph (b), ''Current engine certification regulations do not adequately address the requirements of a single combining gearbox; therefore, in addition to the engine requirements of § 23.903, the CGB will be required to complete a 200 hour endurance test that is patterned after the rotor drive system requirements of § 29.923. The endurance test is intended to exercise the integration of the engines, combining gearbox and loading characteristics of the intended propeller.'' Therefore, the intent of the special condition is not met with current part 33 standards. However, if the requirements of the special condition are adequately met during engine certification, this data may be used.

5. When the special conditions sections were renumbered from the prior drafts for publication, several section references within the text were not updated to correspond with the new section numbers.

Resolution: Adopted. The paragraphs will be renumbered as recommended.

6. A commenter recommended defining the LHTEC acronym at the beginning of the preamble and the special conditions:

Resolution: Adopted. The acronym will be defined as recommended.

7. A commenter suggested that we add missing word ''interval'' after ''inspection'' in paragraph 2(b)(4)(ii):

Resolution: Adopted. The word ''interval'' will be added.'

8. A commenter requested that we correct the section heading for 2(b)(4)(iii)(c) to change paragraph (c) to a lower case (c):

Resolution: Adopted. Case will be changed to lower ''c.''

9. A commenter had the following concerns on issues affecting safety levels in the LM200 design:

For conventional twin engine Joint Aviation Requirements (JAR) 23 commuter airplanes, the probability of a hazardous or catastrophic event resulting from a turbine engine or propeller failure is in the order of 2×10^{-7} per hour. Accordingly, the reliability of the LM200 Propulsion System Unit (PSU) should maintain this safety target. Also, the JAA's ANPA on the subject of single engine IFR/Night operations contains a target fatal accident rate of 5×10^{-6}.

Resolution: Not adopted. Recommendations made are considerations for compliance with already existing part 23 requirements (i.e., 14 CFR, part 23, § 23.903(c)) or the requirements are already contained in the proposed special conditions and do not require additional requirements.

10. The Civil Aviation Authority notes that under the background there is a statement that the aircraft will be limited to a maximum of nine passengers. It is not clear whether this affects the certification requirements. If the LM200 will be operated as a commuter category aircraft, then the reliability/safety target should be the same as existing commuter airplanes. If the FAA intends something different than this, the commenter believes it should be stated in the FAA Issue Paper.

Resolution: Not adopted. As previously discussed, this is addressed separately from the proposed special conditions (an exemption to 14 CFR, part 23, § 23.3(d), the multi-engine requirement was needed).

11. Also under the background, the same commenter states that the issues to be considered include prevention of single failures resulting in unacceptable levels of unbalance and the capability to continue safe flight to a landing. The background also states that the possibility of catastrophic failure modes should be minimized. The commenter believes that the word minimize is too subjective and would like to have specific safety targets. Acceptable wording could be something along the lines of ''the possibility of catastrophic failure modes should be such that the overall catastrophic failure rate will remain equivalent to that of existing commuter airplanes.'' Again, if this is not the FAA's intention, this needs to be clarified in the FAA Issue Paper.

Resolution: Not adopted. The intention was not to maintain the same level of safety as the current Commuter Category airplanes but rather to develop requirements for the unique design features of the airplane, per 14 CFR, part 21, § 21.16.

12. The Civil Aviation Authority (CAA) notes that under the type certification basis, in the 'FAA Position,' the paper states that engine isolation is a significant requirement with respect to this 'new' powerplant configuration. The CAA concurs with the FAA's position that the existing requirements (23.903(c)) are adequate. However as both engines are to be certificated together with the CGB as a single powerplant, the requirement for § 23.903 should be added as a special condition to the powerplant certification basis.

Resolution: Not adopted. The commenter is addressing the engine certification basis/requirements while the proposed special conditions address airplane requirements.

17. The Civil Aviation Authority had some concerns about the definitions of powerplant, engine, propulsion system unit, and multi-engine. They made the following recommendation:

Powerplant—Agree with the definition; do not see the relevance of stating power output.

Engine—Simply state which parts of the powerplant constitute an engine.

Propulsion System Unit—States that the CGB lubrication system is part of the PSU. (Note: As this equipment is fundamental to powerplant reliability, it will need to be represented accurately in the powerplant safety analysis.)

Multi-engine—Term does not need to be defined and its use in this context is misleading. The OEI capability of the powerplant will be defined during certification. It is made clear that ''multi-engine'' for this configuration does not satisfy the requirement of JAR 23.1(a)(2), this being interpreted as requiring independent propulsion systems. This definition describes the intent to type certificate the powerplant and not the engine. This is a fundamental issue and should not be addressed only under definitions.

Resolution: The changes were not adopted. We believe that the definitions do help with the understanding that the powerplant system and its installation is unique.

18. The CAA asked that the FAA base the failure analysis of the PSU on JAR E510 and JAR P70 as it comprises engines, CGB, and a propeller.

Resolution: Not adopted. We believe that the safety assessment and critical parts control requirements proposed, which are based upon standards currently used by turboshaft engines used in rotorcraft, are sufficient to address the level of certitude needed for this installation.

19. The CAA recommends actions for (1) engine certification requirements and (2) special conditions to address the CGB lubrication system.

Resolution: (1) Not adopted. The proposed special conditions address airplane requirements and not engine certification requirements. (2) Special Conditions are proposed for the CGB lubrication system (i.e., ability to continue flight after a lubrication system failure).

20. The Civil Aviation Authority recommends that the special conditions address the effect of environmental factors, such as bird and lightning strike, to assess the PSU and to demonstrate that the PSU will continue to provide thrust in such an event.

Resolution: Not adopted. There is nothing unique about the installation to require unique considerations of environmental conditions.

Conclusion

This action affects only certain novel or unusual design features on one model of airplane. It is not a rule of general applicability, and it affects only the applicant who applied to the FAA for approval of these features on the airplane.

List of Subjects in 14 CFR Part 23

Aircraft, Aviation safety, Signs and symbols.

Citation

The authority citation for these special conditions is as follows:

Authority: 49 U.S.C. 106(g), 40113 and 44701; 14 CFR 21.16 and 21.17; and 14 CFR 11.38 and 11.19.

The Special Conditions

Accordingly, as delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for the Ayres Corporation Model LM 200 airplanes.

Definitions

For purposes of this certification program and subsequent special conditions, the following definitions will apply:

Powerplant—The Light Helicopter Turbine Engine Company (LHTEC) Model CTP800–4T powerplant, consists of two CTS800 derivative turboprop engines, a GKN Westland combining gearbox (CGB), and the engine assembly support structure. The powerplant is capable of providing 2,700 shp combined output power at takeoff and 1,350 shp with one engine inoperative. The CTP800–4T powerplant will obtain a 14 CFR part 33 type certificate identifying the powerplant as a ''twin power section turboprop assembly.''

Engine—An LHTEC CTS800 derivative, non-regenerative, front drive, free turbine power section, which includes compressor, combustor, turbine and accessories group. Each engine of the CTP800–4T is separately controlled by a fully redundant full authority digital electronic control (FADEC). The two engines will only be certified as part of the CTP800–4T powerplant. The CTP800–4T type certificate data sheet will include ratings and limitations for each engine in addition to that of the powerplant.

Engine Assembly Support Structure—The supporting structure that connects the two engines to the CGB. This structure will be 14 CFR part 33 certified as part of the CTP800–4T powerplant.

Propulsion System Unit (PSU)—The LHTEC Model CTP800–4T powerplant plus the airframe-mounted non-integrated lubrication system components, which include the CGB oil tank and CGB/engine oil cooler as well as a single Hamilton Sundstrand 568F–11 propeller system.

Combining Gearbox (CGB)—All components necessary to transmit power from the engines to the propeller. This includes couplings, supporting bearings for shafts, brake assemblies, clutches, gearboxes, transmissions, any attached accessory pads or drives, and any cooling fans that are attached to, or mounted on, the gearbox. The CGB will be 14 CFR part 33 certified as part of the CTP800–4T powerplant.

Multi-Engine—For the Model LM 200 and its powerplant configuration, ''multi-engine'' refers to the twin engine capability and ratings of the CTP800–4T powerplant in regard to type certification in the commuter category and flight operations.

One Engine Inoperative (OEI)—For the Model LM 200 airplane, ''one engine inoperative'' refers to a condition in which one engine of the CTP800–4T powerplant is not operational and the operation of the propeller is unchanged.

Accordingly, the Federal Aviation Administration (FAA) proposes the following special conditions as part of the type certification basis for the Ayres Corporation Model LM 200 airplanes.

1. PSU Reliability

(a) A PSU System Safety Analysis is required and must identify all hazardous or catastrophic failures associated with the unique design of the PSU. The analysis must consider factors such as lack of redundancy, quality of manufacture and maintenance for continued airworthiness, including consideration of anticipated human errors. Critical procedures must be identified for consideration as required inspection items.

(b) Critical part failures identified in the PSU System Safety Analysis, which result in hazardous or catastrophic events on the airplane, shall be controlled via a Critical Parts Plan. The Critical Parts Plan must be established to ensure that each critical part is designed and then controlled through manufacture and maintained throughout its service life by the following:

(1) Enhanced procurement and manufacturing techniques,

(2) Continued airworthiness requirements,

(3) Conservative life limits.

Additionally, best industry practices shall be utilized in the definition and implementation of these critical parts.

(c) Critical failure modes identified in the PSU System Safety Analysis, which could occur due to the indirect failure of a component or system, should be addressed with appropriate design features to mitigate the potential results of such events.

(d) An appropriate inspection interval and instructions shall be established for any possible latent failure of fail-safe backup components.

(e) All fail-safe designs must be approved by test or analysis under the most adverse operational conditions and failure modes. A means of annunciating failure of the primary system, which could affect the safe operation of the airplane, must be provided to the pilot or maintenance crew.

2. Powerplant Requirements

(a) Vibration.

(1) It must be demonstrated by analysis, test, or combination thereof, that high-energy rotating turbomachinery failures that create high-energy rotor unbalance should not affect the operation of the CGB, the healthy engine by vibration transmitted through the CGB, the integrity of the airframe, powerplant, engine mounts, or the engine assembly support structure and attachments, or prevent continued safe flight and landing.

(2) High-energy fragment and fire shielding and surrounding engine structure and attachments, if attached to the engine, should be included in the rotor dynamics analysis or any test that affects the rotors.

(b) CGB Design, Endurance Testing and Additional Tests.

(1) CGB Design. The CGB must meet the requirements as set forth in paragraphs 2(b)(1)(i) through 2(b)(4).

(i) The CGB must incorporate a device to automatically disengage any engine from the propeller shaft if that engine fails.

(ii) The oil supply for components of the CGB that require continuous lubrication must be sufficiently independent of the lubrication systems of the engine(s) to ensure operation without damage to the CGB, with any engine inoperative. Each independent lubrication system must function properly in the flight attitudes and atmospheric conditions in which an airplane is expected to operate.

(iii) Torque limiting means must be provided on all accessory drives that are located on the CGB in order to prevent the torque limits established for those drives from being exceeded.

(2) CGB Endurance Tests. Each part tested, as prescribed in this section, must be in serviceable condition at the end of the tests. No intervening

disassembly that might affect these results may be conducted. An endurance test report explaining the test results and documenting the pre- and post-test wear measurements should be completed.

(i) Endurance tests; general. In addition to the 150-hour powerplant test requirements of § 33.87, the CGB must be tested as prescribed in paragraphs 2(b)(2)(ii) through 2(b)(2)(ix), for at least 200 hours plus the time required to meet paragraph 2(b)(2)(ix). These tests must include the engines as well as the vibration and loading characteristics of the propeller and allowable takeoff imbalance tolerance. For the 200-hour portion, these tests must be conducted as follows:

(A) Twenty each, ten-hour test cycles consisting of the test times and procedures in paragraphs 2(b)(2)(i) through 2(b)(2)(viii); and

(B) The test torque must be determined by actual powerplant limitations.

(ii) Endurance tests; takeoff torque run. The takeoff torque endurance test must be conducted as follows with both engines operating at, or CGB input shafts loaded to, the same conditions:

(A) The takeoff torque run must consist of one hour of alternating runs of five minutes operating at the torque and speed corresponding to takeoff power, and five minutes at as low a powerplant idle speed as practicable. This should be done with no airframe power extractions to produce the highest takeoff torque and lowest idle.

(B) Deceleration and acceleration must be performed at the maximum rate. (This corresponds to a one-second power setting change from idle to takeoff and one second from takeoff to idle setting.) This should also be conducted with no airframe power extractions.

(C) The time duration of all engines at takeoff power settings must total one hour and does not include the time at idle and the time required to go from takeoff to idle and back to takeoff speed.

(iii) Endurance tests; maximum continuous run. Three hours of continuous operation, at the torque corresponding to maximum continuous power and speed, must be conducted with maximum airframe power extractions.

(iv) Endurance tests; 90 percent of maximum continuous run. One hour of continuous operation, at the torque corresponding to 90 percent of maximum continuous power at maximum continuous rotational propeller shaft speed with maximum airframe power extractions.

(v) Endurance tests; 80 percent of maximum continuous run. One hour of continuous operation, at the torque corresponding to 80 percent of maximum continuous power at the minimum rotational propeller shaft speed intended for this power with maximum airframe power extractions.

(vi) Endurance tests; 60 percent of maximum continuous run. Two hours of continuous operation, at the torque corresponding to 60 percent of maximum continuous power at the minimum rotational propeller shaft speed intended for this power with maximum airframe power extractions.

(vii) Endurance tests; engine malfunctioning run. It must be determined whether malfunctioning of components, such as the engine fuel or ignition systems, or unequal engine power distribution can cause dynamic conditions detrimental to the drive system. If so, a suitable number of hours of operation must be accomplished under those conditions, one hour of which must be included in each cycle and the remaining hours of which must be accomplished at the end of 20 cycles. This testing is to be divided between the following four conditions by alternating between cycles: (1) engine #1 ''ON''/ engine #2 ''IDLE''; (2) engine #1''ON''/ engine #2 ''OFF''; (3) engine #1 ''IDLE''/ engine #2 ''ON''; (4) engine #1 ''OFF''/ engine #2 ''ON''. If no detrimental condition results, an additional hour of operation in compliance with paragraph (B) of this section must be conducted. This will require 100 percent transfer of the airframe air, electrical, and hydraulics to the operating engine within approved Installation Manual limitations.

(viii) Endurance tests; overspeed run. One hour of continuous operation must be conducted at the torque corresponding to maximum continuous power and at 110 percent of rated maximum continuous rotational propeller shaft speed. This should be performed without airframe power extractions for highest speed. If the overspeed is limited to less than 110 percent of maximum continuous speed by the speed and torque limiting devices, the speed used must be the highest speed allowable assuming that speed and torque limiting devices, if any, function properly.

(ix) Endurance tests; one-engine-inoperative application. A total of 160 full differential power applications must be made at takeoff torque and RPM. If, during these tests, it is found that a critical dynamic condition exists, an investigative assessment to determine the cause shall be performed throughout the torque/speed range. In each of the 160 power setting cycles (160 per engine) a full differential power application must be performed. In each cycle, the transition from clutch engagement to disengagement must occur at the critical condition for clutch and shaft wear.

(3) Additional CGB Tests. Following the 200-hour endurance test, and without any intervening major disassembly, additional dynamic, endurance, and operational test and vibratory investigations must be performed to determine that the drive mechanism is safe. The following additional tests and conditions apply:

(i) If the torque output of both engines to the CGB can exceed the highest engine or CGB torque limit, the following tests must be conducted. Under conditions with both engines operating, apply 200 cycles to the CGB for 10 seconds each of an input torque that is at least equal to the lesser of—

(A) The maximum torque used in complying with paragraph 2(b)(3)(ii) plus 10 percent; or

(B) The maximum torque attainable under normal operating conditions, assuming that any torque limiting devices function properly.

(ii) With each engine alternately inoperative, apply the maximum transient torque attainable under normal operating conditions, assuming that any torque limiting devices function properly. Each CGB input must be tested at this maximum torque for at least one hour.

(iii) The CGB must be subjected to 50 overspeed runs, each 30 plus or minus 3 seconds in duration, at a speed of at least 110 percent of maximum continuous speed or other maximum overspeed that is likely to occur plus a margin of speed approved by the Administrator for that overspeed condition. These runs must be conducted as follows:

(A) Overspeed runs must be alternated with stabilizing runs from 1 to 5 minutes duration, each 60 to 80 percent of maximum continuous speed.

(B) Acceleration and deceleration must be accomplished in a period no longer than 10 seconds, and the time for changing speeds may not be deducted from the specified time for the overspeed runs.

(iv) Each part tested, as prescribed in this section, must be in serviceable condition at the end of the tests. No intervening disassembly that might affect test results may be conducted.

(v) If drive shaft couplings are used and shaft misalignment or deflections are probable, loads must be determined in establishing the installation limits affecting misalignment. These loads must be combined to show adequate fatigue life.

(vi) The CGB must be able to continue safe operation, although not necessarily without damage, at a torque and rotational speed prescribed by the applicant that is determined to be the most critical of the anticipated flight conditions for at least one hour after perception by the flight crew of the CGB primary lubrication system failure or loss of lubricant. The demonstrated torque and rotational speed must be included in the instruction manual for installing and operating the engine required in 14 CFR part 33.5.

(4) Fatigue Evaluation. The critical parts of the CGB must be shown by analysis supported by test evidence and, if available, service experience to be of fatigue tolerant design. The fatigue tolerance evaluation must include the requirements of either paragraph (2)(b)(4)(i), (ii), or (iii) of this section, or a combination thereof, and must include a determination of the probable locations and modes of damage caused by fatigue, considering environmental effects, intrinsic/discrete flaws, or accidental damage. Compliance with the flaw tolerance requirements of paragraph (2)(b)(4)(i) or (ii) of this section is required unless the applicant establishes that these fatigue flaw tolerant methods for a particular part cannot be achieved within the limitations of geometry, inspectability, or good design practice. Under these circumstances, the safe-life evaluation of paragraph (iii) of this section is required.

(i) Flaw tolerant safe-life evaluation. It must be shown that the critical part, with flaws present, is able to withstand repeated loads of variable magnitude without detectable flaw growth for the following time intervals—

(A) Life of the airplane; or

(B) Within a replacement time furnished in the Instructions for Continued Airworthiness.

(ii) Fail-safe (residual strength after flaw growth) evaluation. It must be shown that the critical part after a partial failure is able to withstand design limit loads without failure within an inspection interval per the Instructions for Continued Airworthiness. Limit loads are defined in § 23.301(a).

(A) The residual strength evaluation must show that the critical part after flaw growth is able to withstand design limit loads without failure within its operational life.

(B) Inspection intervals and methods must be established as necessary to ensure that failures are detected prior to residual strength conditions being reached.

(C) If significant changes in structural stiffness or geometry, or both, follow from a structural failure or partial failure, the effect on flaw tolerance must be further investigated.

(iii) Safe-life evaluation. It must be shown that the critical part is able to withstand repeated loads of variable magnitude without detectable cracks for the following time intervals—

(A) Life of the airplane; or

(B) Within a replacement time furnished in the Instructions for Continued Airworthiness.

(C) Powerplant and Engine Mounts.

(*1*) All principal structural elements of the powerplant and engine mount structure that could fail as a result of an uncontained engine failure or resulting fire must be fail-safe as defined in § 23.571(b). All other principal structural elements of the powerplant and engine mount system must either be fail-safe or meet the damage tolerance criteria of § 23.574(a).

(*i*) For fail-safe design:

(*A*) The fail-safe structure must be able to withstand the limit loads, considered as ultimate, given in §§ 23.361 and 23.363.

(*B*) If the occurrence of load-inducing propeller control systems malfunctions is less frequent than 1×10^{-5} occurrences per flight hour, and if it can be demonstrated that failure or partial failure of a structural element would be obvious, the engine torque loads of § 23.361(a)(3) do not need to be considered in the fail-safe design.

(*ii*) If damage tolerance evaluation is used,

(*A*) The residual strength evaluation must consider the limit loads, considered as ultimate, given in §§ 23.361 and 23.363.

(*B*) If the occurrence of load-inducing propeller control system malfunctions is less frequent than 1×10^{-5} occurrences per flight hour, the engine torque loads of § 23.362(a)(3) do not need to be considered in the residual strength evaluation.

3. Propeller Installation

(a) The applicant must complete a 2,500 airplane cycle evaluation of the propeller installation. A cycle must include the power levels associated with ground idle, takeoff, climb cruise, and descent. This evaluation may be accomplished on the airplane in a combination of ground and flight cycles or on a ground test facility. If the testing is accomplished on a ground test facility, the test configuration must include sufficient interfacing system hardware to simulate the actual airplane installation, including the engines, CGB, and mount system. Each part tested, as prescribed in this section, must be in serviceable condition at the end of the tests. No intervening disassembly, other than normal maintenance (as defined for the installation), that might affect these results may be conducted. A test report explaining the test results and documenting the pre- and post-test condition should be completed.

(b) Propeller Unbalance. It must be shown by a combination of testing and analysis that any single failure or probable combination of failures not deemed a critical part under paragraph 1(b) that could cause an unbalanced propeller condition will not cause damage to the engines, CGB, powerplant mount system, primary airframe structure, or to critical equipment that would jeopardize the continued safe flight and landing of the airplane. Furthermore, the degree of flight deck vibration must not jeopardize the crew's ability to continue to operate the airplane in a safe manner. The magnitude and frequency of the vibration should be included in the installation manual. Any part (or parts) whose failure (or combination of failures) would result in a propeller unbalance greater than the defined maximum should also be classified as critical.

(c) A means must be provided to prevent any adverse effect resulting from rotation of the propeller, in either direction, on the ground.

4. Propeller Control System

(a) The propeller control must be independent of the engines such that a failure in either engine or any engine control system will not result in failure to control the propeller.

(b) The propeller control system must be designed to minimize the occurrence of any single failure that would prevent the propulsion system from producing thrust at a level required to meet §§ 23.53(c), 23.67(c), 23.69, 23.75, and 23.77(c).

(c) An uncommanded propeller pitch change must not result in an unsafe condition and an indication of the failure must be annunciated to the flight crew.

5. PSU Instrumentation

(a) Engine Failure Indication. A means must be provided to indicate when an engine is no longer able to provide torque, or to provide stable torque, to the propeller. This means may consist of instrumentation required by other sections of part 23 or these special conditions if it is determined that those instruments will readily alert the flight crew when an engine is no longer able to provide torque, or to provide stable torque, to the propeller. This indicator must preclude confusion by the flight crew in reacting to the failure and when taking appropriate action to secure the airplane in a safe condition for continued flight.

(b) Engine/Propeller Vibration Exceedance Indication. A means must be provided to indicate when the PSU vibration levels exceed the maximum vibration level defined for continuous operation. Procedures to respond to this exceedance should be included in the AFM.

(c) The engine instrumentation requirements of § 23.1305 (a), (c), and (e) shall apply to each engine as defined in these special conditions.

(d) In addition to the requirements of § 23.1305, the following instruments must be provided:

(1) An oil pressure warning means and indicator for the pressure-lubricated CGB to indicate when the oil pressure falls below a safe value.

(2) A low oil quantity indicator for the CGB, if lubricant is self-contained;

(3) An oil temperature warning device to indicate unsafe CGB temperatures;

(4) A tachometer for the propeller;

(5) A propeller pitch control failure indication;

(6) A torquemeter for each engine if the sum of the maximum torque that each engine is capable of producing exceeds the maximum torque for which the CGB has been certified under 14 CFR part 33; and

(7) A chip detecting and indicating system for the CGB.

6. Fire Protection, Extinguishing, and Ventilation Systems

(a) Each engine must be isolated from the other engine and CGB by firewalls, shrouds or equivalent means. Each firewall or shroud, including applicable portions of the engine couplings, must be constructed such that no hazardous quantity of liquid, gas, or flame can pass between the isolated fire zone of each engine or the CGB compartment.

(b) In addition to the engine fire zones, if the potential for fire exists in the CGB compartment, then the CGB must be in a separate fire zone and must comply with all fire protection requirements of 14 CFR part 23. Enough fire-extinguishing agent will be required for the CGB compartment and at least one engine compartment. A dedicated fire extinguishing system will be required for the CGB compartment. If the potential for fire does not exist within the CGB compartment, this must be substantiated by analysis.

(c) Firewall temperatures under all normal or failure conditions must not result in auto-ignition of flammable fluids and vapors present in the other engine compartment and the CGB compartment.

(d) The CGB compartment ventilation system must be designed such that:

(1) It is ventilated to prevent the accumulation of flammable vapors.

(2) No ventilation opening may be where it would allow the entry of flammable fluids, vapors or flame from other zones.

(3) Each ventilation means must be arranged so that no discharged vapors will cause an additional fire hazard.

(4) Unless the extinguishing agent capacity and rate of discharge are based on maximum airflow through the compartment, there must be a means to allow the crew to shut off sources of forced ventilation.

7. Cargo or baggage compartment requirements

(a) Flight tests must demonstrate means to exclude hazardous quantities of smoke, flames or extinguishing agent from any compartment occupied by the crew or passengers.

(b) Cargo compartments shall have either fire or smoke detection provisions, or both, unless the compartment location is such that a fire can be easily detected by the pilots seated at their duty station. The cargo and baggage fire protection must be in accordance with § 23.855 as well as the following:

(1) The detection system must provide a visual indication to the flight crew within one minute after the start of a fire.

(2) The system must be capable of detecting a fire at a temperature significantly below that at which the structural integrity of the airplane is substantially decreased.

(3) There must be means to allow the crew to check the functioning of each fire detector circuit while in flight.

(4) The detection system effectiveness must be shown for all approved operating configurations and conditions.

(c) The flight crew must have means to shut off the ventilating airflow to, or within, the compartment from the pilot's station on the all-cargo configuration.

(d) Passenger and combi configurations, where the cargo compartment is not accessible to the flight crew, must have an approved built-in fire extinguishing system. The built-in fire extinguishing system shall be controllable from the pilots' station. There must be means to control ventilation and drafts within the inaccessible cargo compartment so that the extinguishing agent can control any fire that may start within the compartment. The built-in fire extinguisher must be installed so that no extinguishing agent likely to enter personnel compartments will be hazardous to the occupants. The discharge of the extinguisher must not cause structural damage. The capacity of the extinguishing system must be adequate for any fire likely to occur in the compartment where used. Consideration must be given to the volume of the compartment and the ventilation rate.

(e) In addition to the hand fire extinguishers required by § 23.851, a hand fire extinguisher must be readily accessible for use in each cargo or baggage compartment that is accessible to crewmembers in flight. Hazardous quantities of smoke, flames or extinguishing agent must not enter any compartment occupied by the crew or passengers when the access to that compartment is used.

(f) Protective breathing equipment must be installed for crewmembers in each crewmember compartment. Protective breathing equipment must:

(1) Be designed to protect the flight crew from smoke, carbon dioxide, and other harmful gases at the pilot's station and while combating fires in cargo compartments.

(2) Have masks that cover the eyes, nose, and mouth; or masks that cover the nose and mouth plus accessory equipment to cover the eyes.

(3) Allow the flight crew to use the radio equipment and to communicate with each other while at their assigned stations.

(4) Not cause any appreciable adverse effect on vision and must allow corrective glasses to be worn.

(5) Supply protective oxygen of 15 minutes duration per crewmember at a pressure altitude of 8,000 feet with a respiratory minute volume of 30 liters per minute BTPD. If a demand oxygen system is used, a supply of 300 liters of free oxygen at 70° F and 760 mm. Hg. pressure is considered to be of 15 minute duration at the prescribed altitude and minute volume. If a continuous flow protective breathing system is used (including a mask with a standard rebreather bag) a flow rate of 60 liters per minute at 8,000 feet (45 liters per minute at sea level) and a supply of 600 liters of free oxygen at 70° F and 760 mm. Hg. pressure is considered to be of 15 minute duration at the prescribed altitude and minute volume. BTPD refers to body temperature conditions (that is, 37° C, at ambient pressure, dry).

(6) Be free from hazards in itself, in its method of operation, and in its effect upon other components.

(7) Have a means to allow the crew to readily determine, during flight, the quantity of oxygen available in each source of supply.

8. Airplane Performance

(a) In addition to the takeoff performance requirements of § 23.53(c), the same requirements must be met with both engines operating normally and the propeller primary control system failed in the most critical thrust producing condition at VEF and above, considering all single point failures.

(b) In addition to the one engine inoperative climb requirements of § 23.67(c), the same requirements must be met with both engines operating normally and the propeller primary control system failed in the most critical thrust producing condition, considering all single point failures.

(c) In addition to the requirements of § 23.69, the steady gradient and rate of climb/descent must be determined at each weight, altitude, and ambient temperature within the operational limits established by the applicant with both engines operating normally and the propeller primary control system failed in the most critical thrust producing condition, considering all single point failures.

(d) In addition to § 23.75, the horizontal distance necessary to land and come to a complete stop from a point 50 feet above the landing surface must be determined as required in § 23.75 with both engines operating normally and the propeller primary control system failed in the most critical thrust producing conditions, considering all single point failures.

(e) The balked landing requirements of § 23.77(c) must be performed with the propeller primary control system failed in the most critical thrust producing condition, considering all single point failures.

9. Airplane Flight Manual

(a) In addition to the requirements of §§ 23.1583(b) and 23.1585(a), a pre-flight visual inspection of the propeller components must be included in the Airplane Flight Manual.

(b) In addition to the requirements of § 23.1585(c), procedures for maintaining or recovering control of the airplane in all conditions identified in section 8 of these special conditions must be included in the Airplane Flight Manual.

(c) The information required by § 23.1583(c)(4) and § 23.1587(d) must be furnished with the propeller control system failed or with one engine inoperative, whichever is more critical.

10. Suction Defueling

(a) The airplane defueling system (not including fuel tanks and fuel tank vents) must withstand an ultimate load that is 2.0 times the load arising from maximum permissible defueling pressure (positive or negative) at the airplane fueling connection.

11. FADEC Installation

(a) The installation of the electronic engine/propeller control (FADEC control system) must comply with the requirements of § 23.1309 (a) through (e).

Issued in Kansas City, Missouri on September 24, 2001.

Michael Gallagher,

Manager, Small Airplane Directorate, Aircraft Certification Service.

[FR Doc. 01–25084 Filed 10–4–01; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 23

[Docket No. CE170, Special Condition 23–109–SC]

Special Conditions; Byerly Aviation; Twin Commander Models 690, 690A, 690B, 690C, 690D, 695, 695A, and 695B; Protection of Systems for High Intensity Radiated Fields (HIRF)

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final special conditions; request for comments.

SUMMARY: These special conditions are issued to Byerly Aviation, Inc., Greater Peoria Regional Airport, 6100 EM Dirksen Parkway, Peoria, Illinois 61607, for a Supplemental Type Certificate for Twin Commander model series 690/695 airplanes. This airplane will have novel and unusual design features when compared to the state of technology envisaged in the applicable airworthiness standards. These novel and unusual design features include the installation of an electronic flight instrument system (EFIS), manufactured by Meggitt Avionics, for which the applicable regulations do not contain adequate or appropriate airworthiness standards for the protection of these systems from the effects of high intensity radiated fields (HIRF). These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to the airworthiness standards applicable to these airplanes.

DATES: The effective date of these special conditions is September 17, 2001. Comments must be received on or before November 5, 2001.

ADDRESSES: Comments may be mailed in duplicate to: Federal Aviation Administration, Regional Counsel, ACE–7, Attention: Rules Docket Clerk, Docket No. CE170, Room 506, 901 Locust, Kansas City, Missouri 64106. All comments must be marked: Docket No. CE170. Comments may be inspected in the Rules Docket weekdays, except Federal holidays, between 7:30 a.m. and 4:00 p.m.

FOR FURTHER INFORMATION CONTACT: Ervin Dvorak, Aerospace Engineer, Standards Office (ACE–110), Small Airplane Directorate, Aircraft Certification Service, Federal Aviation Administration, 901 Locust, Room 301, Kansas City, Missouri 64106; telephone (816) 329–4123.

SUPPLEMENTARY INFORMATION: The FAA has determined that notice and opportunity for prior public comment hereon are impracticable because these procedures would significantly delay issuance of the approval design and thus delivery of the affected aircraft. In addition, the substance of these special conditions has been subject to the public comment process in several prior instances with no substantive comments received. The FAA, therefore, finds that good cause exists for making these special conditions effective upon issuance.

Comments Invited

Interested persons are invited to submit such written data, views, or arguments as they may desire. Communications should identify the regulatory docket or notice number and be submitted in duplicate to the address specified above. All communications received on or before the closing date for comments will be considered by the Administrator. The special conditions may be changed in light of the comments received. All comments received will be available in the Rules Docket for examination by interested persons, both before and after the closing date for comments. A report summarizing each substantive public contact with FAA personnel concerning this rulemaking will be filed in the docket. Commenters wishing the FAA to acknowledge receipt of their comments submitted in response to this notice must include a self-addressed, stamped postcard on which the following statement is made: ‘‘Comments to