

the components necessary for its functioning, but not necessarily included in the propeller type design.

(3) Hazardous propeller effects. The following are regarded as hazardous propeller effects:

- (i) A significant overspeed of the propeller.
- (ii) The development of excessive drag.
- (iii) Thrust in the opposite direction to that commanded by the pilot.
- (iv) A release of the propeller or any major portion of the propeller.
- (v) A failure that results in excessive unbalance.
- (vi) The unintended movement of the propeller blades below the established minimum in-flight low pitch position.

(4) Major propeller effects. The following are regarded as major propeller effects.

- (i) An inability to feather.
- (ii) An inability to command a change in propeller pitch.
- (iii) A significant uncommanded change in pitch.
- (iv) A significant uncontrollable torque or speed fluctuation.

(b) *Safety analysis.*

(1)(i) Perform an analysis of the propeller system to assess the likely consequence of all failures that can reasonably be expected to occur. This analysis must consider the following:
(A) The propeller system in a typical installation. When the analysis depends on representative components, assumed interfaces, or assumed installed conditions, the analysis must state the assumptions.

(B) Consequential secondary failures and latent failures.

(C) Multiple failures referred to in paragraph (b)(4) of these special conditions or that result in hazardous propeller effects.

(ii) Summarize those failures that could result in major propeller effects or hazardous propeller effects, together with an estimate of the probability of occurrence of those effects.

(iii) Show that hazardous propeller effects are not predicted to occur at a rate in excess of that defined as extremely remote (probability of 10^{-7} or less per propeller flight hour). As the estimated probability for individual failures may be insufficiently precise to enable the applicant to assess the total rate for hazardous propeller effects, compliance may be shown by demonstrating that the probability of a hazardous propeller effect arising from any individual failure can be predicted to be not greater than 10^{-8} per propeller flight hour. Probabilities of this low order of magnitude may be demonstrated through reliance on

engineering judgment and previous experience combined with sound design and test philosophies.

(2) The Administrator may, if significant doubt exists, require testing to verify any assumption as to the effects of failures or likely combination of failures.

(3) If the primary failure of certain single elements (for example, blades) cannot be sensibly estimated in numerical terms, and if the failure of such elements is likely to result in hazardous propeller effects, then compliance may be shown by meeting the prescribed integrity requirements of part 35 and these special conditions. The safety analysis must state these instances.

(4) If reliance is placed on a system or device, such as safety devices, feathering and overspeed systems, instrumentation, early warning devices, maintenance checks, and similar equipment or procedures, to prevent a failure from progressing to hazardous propeller effects, the analysis must include the possibility of a safety system failure in combination with a basic propeller failure. If items of a safety system are outside the control of the propeller manufacturer, the safety analysis must state assumptions with respect to the reliability of these parts, and the installation and operation instructions required under § 35.3 must identify these assumptions.

(5) If the safety analysis depends on one or more of the following items, the analysis must state and appropriately substantiate those items.

(i) Performance of mandatory maintenance actions at stated intervals required for certification and other maintenance actions. This includes verifying the serviceability of items that could fail in a latent manner. These maintenance intervals must be published in the appropriate propeller manuals. Additionally, if errors in maintenance of the propeller system could lead to hazardous propeller effects, the appropriate procedures must be published in the appropriate propeller manuals.

(ii) Verification of the satisfactory functioning of safety or other devices at pre-flight or other stated periods. The details of this satisfactory functioning must be published in the appropriate propeller manuals.

(iii) The provisions of specific instrumentation not otherwise required.

(iv) A fatigue assessment.

(6) If applicable, the safety analysis must include the assessment of indicating equipment, manual and automatic controls, governors and propeller control systems,

synchrophasers, synchronizers, and propeller thrust reversal systems.

(c) *Propeller control system.* The requirements of this section apply to any system or component that controls, limits, or monitors propeller functions.

(1) Design, construct, and validate the propeller control system to show that:

(i) The propeller control system, operating in normal and alternative operating modes and transition between operating modes, performs the intended functions throughout the declared operating conditions and flight envelope.

(ii) The propeller control system functionality is not adversely affected by the declared environmental conditions, including temperature, electromagnetic interference (EMI), high intensity radiated fields (HIRF) and lightning. Document the environmental limits to which the system has been satisfactorily validated in the appropriate propeller manuals.

(iii) A method is provided to indicate that an operating mode change has occurred if flight crew action is required. In such an event, provide operating instructions in the appropriate manuals.

(2) Design and construct the propeller control system so that, in addition to compliance with paragraph (b) of these special conditions, Safety analysis:

(i) A level of integrity consistent with the intended aircraft is achieved.

(ii) A single failure or malfunction of electrical or electronic components in the control system does not cause a hazardous propeller effect.

(iii) Failures or malfunctions directly affecting the propeller control system in a typical aircraft, such as structural failures of attachments to the control, fire, or overheat, do not lead to a hazardous propeller effect.

(iv) The loss of normal propeller pitch control does not cause a hazardous propeller effect under the intended operating conditions.

(v) The failure or corruption of data or signals shared across propellers does not cause a major or hazardous propeller effect.

(3) Design and implement electronic propeller control system imbedded software by a method approved by the Administrator that is consistent with the criticality of the performed functions and minimizes the existence of software errors.

(4) Design and construct the propeller control system so that the failure or corruption of aircraft-supplied does not result in hazardous propeller effects.

(5) Design and construct the propeller control system so that the loss, interruption, or abnormal characteristic