

FEDERAL AVIATION ADMINISTRATION

ROBINSON R-22
FLIGHT STANDARDIZATION BOARD
REPORT
February 15, 1995

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Robinson R-22

Part 1

Original

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REVISION RECORD

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1. PURPOSE AND APPLICABILITY

1.1 The purpose of this report is to specify FAA master training, checking, and currency requirements applicable to airmen operating the Robinson R-22 helicopter under FAR Part 91. One of its primary purposes is to aid Part 61 and Part 141 Air Agencies and FAA Principal Operations Inspectors in the use of applicable training programs.

1.2 Applicability of a Flight Standardization Board is limited due to the fact that the aircraft (R-22) is not designed for scheduled Air Carrier operations.

1.3 The Robinson R-22 is listed in FAA Type certificate Data Sheet H10WE and is hereafter referred to as the "R-22".

1.4 The FSB conducted numerous evaluations of the R-22 in accordance with special detailed information guidelines and the reference material from Advisory Circular 120-53 as applicable, to develop this report. Certain instrument proficiency and training requirements and systems were not evaluated by the FSB because of inapplicability to the training profile or operational use for which the aircraft was intended. The FSB is responsible for evaluating R-22 derivative aircraft and all future changes to the R-22 (such as design modifications or systems changes) when they are made to the aircraft. The FSB then determines the associated impact on training and amends this report accordingly.

1.5 This report also addresses certain issues regarding the operation of the Robinson R-22 other than under FAR Parts 61 and 141. Provisions of the report include:

1.5.1 Describing training program special emphasis items.

1.5.2 Endorsement requirements

1.6 The R-22 is certificated for VFR, day and night operations with a minimum crew of one pilot. It may be used in on-demand operations under FAR Part 135, student training and additional rating instruction, and corporate and private transportation under FAR Part 91. Other possible uses include agricultural operations under Part 137 and external load operations under Part 133.

1.7 The Robinson R-22 Flight Standardization Board met in Torrance, California, on January 8 through 20, 1995. Inspectors Bryan W. Carpenter, William Wallace, Gilbert Riley, and Robert O'Haver were members of the Flight Standardization Board.

1.8 This is the original FSB report relative to the Robinson R-22. Provisions of this report are effective until amended, superseded, or withdrawn by subsequent FSB determinations.

1.9 Terminology

The term "must" is used in this report even though it is recognized that this report and the Advisory Circular AC 120-53 on which it is based, provides one acceptable means, but not necessarily the only means, of compliance with FAR Part 61 Subparts C, D, E, G, and Appendix B requirements. The term "must" acknowledges the need for operators to fully comply with the FSB report provisions of AC 120-53 and is to be used by the operator as its means of complying with the appropriate parts of FAR 61 and 141.

2 PILOT "TYPE RATING" REQUIREMENTS

2.1 The Robinson R-22 has characteristics which makes awareness of certain aerodynamic factors mandatory. The awareness of low "G" operations, rotor blade stall potential, energy management, and low rotor RPM recovery techniques are critical.

2.2 The Robinson R-22 is certificated under Part 27 of the Federal Aviation Regulations with a gross weight less than 12,500 pounds. A type rating is not required to operate this aircraft for purposes for which an Airline Transport Pilot Certificate is not required. The type rating for this aircraft is "R-22" and is listed in Order 8700.1, Volume 2, Chapter 9, Fig 9-3.

3 "MASTER COMMON REQUIREMENTS" (MCRs)

3.1 This section does not apply.

4 "MASTER DIFFERENCE REQUIREMENTS" (MDRs)

4.1 This section does not apply.

5 ACCEPTABLE "OPERATOR DIFFERENCE REQUIREMENTS" (ODRs) TABLES

5.1 This section does not apply.

6 FSB SPECIFICATIONS FOR TRAINING

6.1 General:

6.1.1 The provisions of this section of the report apply to programs for all airmen, experienced or otherwise. This includes airmen beginning initial training, airmen who already hold rotorcraft category and helicopter class ratings on their airman certificates. and flight instructors certificated in rotorcraft-helicopters. Certificated flight schools under FAR Part 141 and operators conducting training under FAR Part 61 are affected. Additional requirements may be necessary for other airmen and will be determined by the operator's POI, the FSB, and AFS-800 as necessary.

6.1.2 There is no manufacturer-provided training program which could be credited toward any FAR Part 135 requirements. Nothing in this version (original) contains requirements for training beyond that which is required by FAR Part 61 for pilot certification.

6.2 Applicability:

6.2.1 Any person wishing to operate a Robinson R-22 should complete a training program designed to enhance awareness of the hazards associated with certain characteristics of light helicopters. Flight conducted in normal operating conditions may cause an encounter with such hazards.

6.3 Awareness Training:

6.3.1 Awareness training can be provided through a ground training program consisting of general subject areas in helicopter operational procedures and aerodynamics. The subject matter should include the development of information in the following areas:

6.3.1.1 Discussion of energy management relative to principles of aerodynamics with references to available energy stored as a result of altitude (potential energy) and reference to available energy developed as a result of rotor RPM and airspeed attained (kinetic energy).

6.3.1.2 Discussions involving the causes and results of "mast bumping" in rotorcraft, and in particular, the R-22. Gyroscopic principles leading to the initiation of mast bumping and the effects of such occurrences are to be discussed.

6.3.1.3 Low rotor RPM (blade stall) discussions to provide additional information regarding the aspect of the actual "stall" condition developed by the blade at low rotor RPM (as opposed to "retreating blade stall"). Aspects of recovery techniques to be used in the event of encountering low rotor RPM, the recognition of

such circumstances, and the corrective actions to be taken to recover RPM should be fully discussed.

6.3.1.4 Discussion of the effects on rotor RPM due to engine failure at high manifold pressure settings, high airspeed operations, or other critical areas of flight including the takeoff profile. The discussion should relate to the enhanced and rapid decay of rotor RPM due to the high drag situation developed as a result of high angles of attack of the blade at the point of engine failure. Where the normal reaction time available to the pilot would meet minimum certification requirements under normal power settings, operating with high angle of attack of the main rotor blades, may leave less time available for recovery and correction of a low rotor RPM condition. Such available time may be of sufficiently short duration as to exceed the pilot's capability to respond.

6.3.1.5 The effects of reduced "G": operations on light helicopters such as the Robinson R-22 in light of the particular characteristics of the teetering rotor system rotor blade system and high tail rotor configuration. When a low "G" situation is encountered, such as an abrupt "pitchover" induced by abrupt forward cyclic motion, or by turbulence, the main rotor disc may become unloaded. A rolling tendency will be encountered which could only be aggravated by the application of controls in any direction other than that which would "load" the disk. The pilots natural tendency to fly the aircraft back to level flight by application of lateral cyclic or anti-torque pedal could lead to mast bumping and subsequent rotor separation without adequate knowledge of the cause of the roll and proper recovery actions necessary for safe continuation of flight.

6.4 Flight Training: Abnormal and Emergency Procedures Flight Training

6.4.1 Emphasis should be placed on the ABNORMAL AND EMERGENCY PROCEDURES FLIGHT TRAINING identified by this FSB report and enhanced flight training should be given in the appropriate subject areas.

6.4.2 All pilots:

6.4.2.1 Pilots should receive enhanced training in autorotation procedures and be able to demonstrate proficiency in autorotations from controlled flight in cruise and approach configurations. As the pilots proficiency level increases, he should be able to demonstrate autorotations from all ranges of normal operational speeds.

6.4.2.2 The pilot must be entirely proficient in the control of engine/rotor RPM without the use of the governor, prior to conducting solo flight operations. Pilot training should

include manual manipulation of the throttle control so as to eliminate complacency and undue reliance on the use of the RPM governor.

6.4.2.3. Additional training is required for pilots in the areas of low rotor RPM recognition and recovery techniques. Low rotor RPM recovery will be initiated from all aspects of the normal flight envelope including hover and cruise flight.

6.4.2.4 Pilots should receive training in recovery from RPM "droop" or low rotor RPM situations during high power settings or high altitude operations. Recognition of the requirement for the immediate application of recovery technique is essential because of the increased drag prevalent on the rotor system during such operations and the reduced RPM decay time available for recovery.

6.4.2.5 Pilots must receive training in the effect of low "G" and the proper use of the controls to effect a safe recovery. The demonstration of such effects will be given by instructors who have demonstrated proficiency in such maneuvers within the limits of the normal envelope of operation. Induced roll maneuvers shall not be permitted and recovery must be initiated at the first sign of unintended divergence from the normal flight path.

6.4.3. Flight Instructors:

6.4.3.1 Instructors should note that autorotation training should not be limited to hover autorotations or autorotations from approach configurations at fixed power settings or pre-established airspeeds. As the student's proficiency level increases, he should be able to demonstrate autorotations from all ranges of normal operational speeds.

6.4.3.2 Instructors providing low rotor RPM recovery training must be proficient in and familiar with the proper techniques for the conduct of demonstrations of such maneuvers. Recovery techniques should not allow the student to continue with the maneuver to the point of making additional mistakes. At the initiation of the maneuver, if the student makes an improper recovery or displays inadequate recovery or control technique, the instructor should take control of the aircraft and abort the demonstration. A second attempt at the maneuver may be made after regaining stable flight. Any attempt to continue the maneuver after improper control input during training or checking is unwise. Instructors will be required to demonstrate proficiency in recovery from low rotor RPM situations during high power settings or high altitude operations. Recognition of the requirement for immediate application of recovery techniques is essential due to the increased drag prevalent on the rotor system during such operations and the reduced RPM decay time available for recovery.

6.4.3.3 Instructors should be able to demonstrate the effects of low "G" and must have demonstrated proficiency in the initiation of the maneuver within the limits of the normal envelope of operation. Instructors must be able to demonstrate proficiency at initiating the proper recovery techniques at the first sign of unintended divergence from the normal flight path.

7 FSB SPECIFICATIONS FOR CHECKING

7.1 Applicability:

7.1.1 FAA Aviation Safety Inspectors (ASI) and Designated Pilot Examiners (DPE) should complete the AWARENESS TRAINING, as outlined above. Following completion of training, DPE's may receive a statement of satisfactory completion of the AWARENESS TRAINING which would include a recommendation for the issuance of a Letter of Authorization. The Flight Standards District Office having geographical responsibility for the DPE may, on the basis of the recommendation, issue a Letter Of Authorization specifically for the Robinson R-22 helicopter to authorize the DPE to conduct pilot certification testing in Robinson aircraft.

7.1.2 Each Certificated Flight Instructor must have an endorsement from a DPE or ASI that the AWARENESS training and ABNORMAL AND EMERGENCY PROCEDURES FLIGHT TRAINING required by this FSB has been successfully completed. The AWARENESS TRAINING should be completed successfully before the CFI will be authorized to act as pilot in command of the aircraft. The ABNORMAL AND EMERGENCY PROCEDURES FLIGHT TRAINING must be completed and proficiency in the maneuvers and procedures must be demonstrated to either an FAA ASI or DPE prior to obtaining an endorsement for authorization to give flight instruction in the Robinson R-22.

7.2 The successful completion of the AWARENESS TRAINING should be determined by means of a written or oral examination with a passing grade of at least 70 percent corrected to 100 percent by oral review.

7.3 The successful completion of the ABNORMAL AND EMERGENCY PROCEDURES FLIGHT TRAINING shall be determined by the standards established in the practical test standards appropriate to the grade of certificate held.

8 FSB SPECIFICATIONS FOR CURRENCY

8.1 All pilots who wish to act as pilot in command of a Robinson R-22 aircraft should complete a flight review as required by FAR Part 61.56 in a Robinson R-22 Model helicopter.

8.2 To meet the currency requirements of FAR Part 61.57, to act as pilot in command of an R-22, the currency requirement must have been accomplished in an R-22 helicopter.

9 AIRCRAFT REGULATORY COMPLIANCE CHECKLIST

With the exception of continued airworthiness, there is no operating rule with which the manufacturer is obligated to show compliance.

10 FSB SPECIFICATIONS FOR DEVICES AND SIMULATORS

This section does not apply.

11 APPLICATION OF FSB REPORT

All relevant parts of this report are applicable to operators on the effective date of this report.

12 ALTERNATE MEANS OF COMPLIANCE

12.1 Approval Level and Criteria:

Alternate means of compliance, other than that specified in this report, must be approved by AFS-800. If an alternate means of compliance is sought, operators will be required to submit a proposed alternate means of approval that provides an equivalent level of safety to the provisions of this FSB report. Analysis, demonstrations, proof of concept testing, differences documentation and/or evidence may be required.

12.2 Interim Programs

In the event of unforeseen circumstances which would not allow an operator to comply with the provisions of this FSB report, the operator may seek an interim program, rather than a permanent alternate means of compliance. Financial arrangements, schedule adjustments, and other similar reasons are not considered "unforeseen circumstances" for the purposes of this provision.

13. MISCELLANEOUS

13.1 The following recommendations of the FSB pertain to the certification of the aircraft and suggested design changes to certain systems as improvements deemed necessary for ensuring safe operations of the R-22.

13.1.1 Carburetor air temperature system should incorporate a relocated probe for accuracy of readings of real time carburetor air temperatures. Application of carburetor heat should be initiated at all low power settings (approaches and autorotations) regardless of atmospheric conditions to preclude engine stoppage due to carburetor ice and reinforce pilot training.

13.1.2 Improved rotor speed governor system for the R-22 to reduce the possibility of rotor speed decay due to pilot inattention.

13.1.3 Longitudinal and lateral dampers in parallel with the R-22 cyclic controls to impede abrupt movement of the cyclic.

13.1.4 Low rotor RPM warning system horn should be made more audible. Wiring through the headphone (ICS) system or audio panel may increase pilot awareness.

13.1.5 Redesign of cyclic system to include incorporation of dual cyclic controls as opposed to single teetering control system so as to increase pilot accessibility at each station.

13.1.6 Modification of Rotor/Engine RPM monitoring system (tachometer) to increase visible marking range for usable rotor RPM range (e.g.; 50% to 116%)

13.1.7 Increase inertia of main rotor system

13.1.8 Revise FAR Part 27 to consider main rotor system inertia in single engine helicopters.