NPRM 90-1

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 29

[Docket No. 24802; Notice No. 90-1]

RIN 2120-AB36

Airworthiness Standards; Transport Category Rotorcraft Performance

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking (NPRM).

SUMMARY: This notice proposes to revise the performance requirements for transport category rotorcraft. The proposed changes are needed to define more clearly the factors for determining takeoff distances for transport category rotorcraft and to add several other relevant standards. If adopted, the changes would provide for an improved level of safety achievable because of recent technological advances in turboshaft engine design and associated rotorcraft design.

DATE: Comments must be received on or before July 9, 1990.

ADDRESSES: Comments on this notice may be mailed in triplicate to: Federal Aviation Administration, Office of the Chief Counsel, Attn: Rules Docket (AGC-10), Docket No. 24802, 800 Independence Avenue SW., Washington, DC 20591, or delivered in triplicate to: FAA Rules Docket, Room 915G, 800 Independence Avenue SW., Washington, DC 20591. All comments must be marked Docket No. 24802. Comments may be inspected in Room 915G, between 8:30 a.m. and 5 p.m. weekdays, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Mr. J.S. Honaker, Regulations Group (ASW-111), Rotorcraft Standards Staff, Aircraft Certification Service, Federal Aviation Administration, Fort Worth, Texas 76193-0111, commercial telephone (817) 624-5109 or FTS 734-5109.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to participate in this proposed rulemaking by submitting such written data, views, or arguments as they may desire. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals contained in this notice are invited. Substantive comments should be accompanied by cost estimates. Comments should identify the regulatory docket or notice number and comments should be submitted in triplicate to the Rules Docket address above. All comments received on or before the closing date for comments will be considered by the Administrator before taking action on this proposed rulemaking. The proposals contained in this notice may be changed in the light of comments received. All comments received will be available, both before and after the closing date for comments, in the Rules Docket for examination by interested persons. A report summarizing each substantive public contact with FAA personnel concerning this proposed 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 preaddressed, stamped postcard on which the following statement is made: "Comments to Docket No. 24802." The postcard will be date stamped and mailed to the commenter.

Availability of NPRM

Any person may obtain a copy of this NPRM by submitting a request to the FAA, Office of Public Affairs, Attention: Public Information Center, APA-430, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267-3484. Communications must identify the notice number of this NPRM.

Persons interested in being placed on a mailing list for future rulemaking documents should also request a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedures.

Background

This notice is based on comments received on an advance notice of proposed rulemaking (ANPRM), Notice No. 85-19, issued October 9, 1985 (50 FR 42126; October 17, 1985), and those comments made at a public meeting held on April 30, 1986 (51 FR 4504; February 5, 1986) in Fort Worth, Texas. Copies of both the meeting transcript and written comments are contained in docket for this NPRM.

Amendment 29-21 (48 FR 4374; January 26, 1983) revised the applicability of part 29 to require that transport category rotorcraft meet an increased level of safety in several areas, including performance. This amendment also specified in more detail when Category A rotorcraft requirements must be met. Category A rotorcraft requirements, when met, assure that multiengine rotorcraft can continue safe flight and landing within specified parameters after failure of the critical engine. Rotorcraft not meeting all Category A requirements must be classified as Category B. Consistent with the revision of Amendment 29-21, there is also a need to define more clearly the determination of takeoff and other performance characteristics. Furthermore, an FAA program to publish guidance material for part 29 uncovered a need for additional part 29 performance requirements. As an example, while Amendment 29-24 (49 FR 44422; November 6, 1984) added a height requirement of 35 feet as a factor in determining Category A takeoff distance, it did not address other factors relevent to transport rotorcraft performance.

Category A pinnacle (rooftop) takeoff and landing criteria were first provided in a policy letter by the FAA in 1961. Due to the infrequent use and, therefore, slow refinements of pinnacle operations, these criteria have not been added to the FAR. However, improved rotorcraft performance and increased recent activity related to pinnacle operations now require consideration of appropriate certification standards.

In addition, the present landing requirements are also in need of clarification. Category A rotorcraft normal landing distances are determined starting from a 50-foot height, but pinnacle landing operations have in the past typically been determined starting from a 25-foot height. Category B rotorcraft landing distances are determined with power off (in autorotation) for single-engine rotorcraft or with one engine inoperative (OEI) for multiengine rotorcraft. Airspeeds used with autorotative (power off) or OEI landings are higher than those that can be used safely for power-on conditions, resulting in longer landing distances. If these autorotative or OEI landing distances are the only information provided to the flightcrew, shorter areas suitable for power-on operations may be precluded from use by operators and their productivity may be adversely affected.

Part 29 currently requires a minimum rate of climb for Category A rotorcraft at the takeoff altitude and 1,000 feet above the takeoff surface but does not specify a minimum gradient of climb at any point. For a specific rate of climb, the gradient of climb decreases as airspeed increases. Therefore,,two rotorcraft with the same rate of climb but different airspeeds must have different considerations for obstacle clearance or noise abatement after takeoff. This presents significant problems in selecting adequately clear areas for heliports, in designing the heliports, and

in determining which rotorcraft may use a specific heliport.

The height-velocity (HV) envelope is a combination of forward airspeed (normally zero to about 35 knots) and heights above the ground (normally 15 to about 400 feet) within which a safe landing may not be assured in the event of an engine failure in a single-engine rotorcraft, and where there is insufficient performance capability to remain airborne in a multiengine rotorcraft. The early Civil Aviation Regulations (CAR) referred to limiting height for autorotative landings and forward speeds. The "limiting height" and "speed" factors have been retained in the FAR, but Amendments 29–21 and 29–24 assured that they are limiting only for Category A rotorcraft and not for Category B or normal category rotorcraft. Although the FAR, including the title of § 29.79, contain height-speed language, all common usage in industry refers to height-velocity. Because a "forward" component is included with the airspeed, the term "velocity" is more appropriate when defining speed and direction. This proposal takes into consideration this change in nomenclature.

Discussion of the Proposals

Five commenters responded to the ANPRM. All commenters support the proposals in general; however, some do object to specific proposals.

The reasons for changes proposed in this notice are included in the specific discussion of each proposal, and each section is identified as a separate proposal.

Section 29.1

This proposal would change the reference in paragraph (e) from § 29.79 to § 29.87, which would become a redesignated section concerning the height-velocity envelope. No comments were received on this proposal.

New § 29.49

This proposal would redesignate § 29.73 as § 29.49 and relocate helicopter hovering performance in the requirements. The transport category concept has been that hovering performance limits all other near-the-ground operations. This is analagous to determining stall speed for an airplane, one of the first performance requirements stated in part 25, since many other airplane performance characteristics are based on stall speed. For rotorcraft other than helicopters, the minimum operating speed may actually be a stall speed. By placing the requirement for hovering performance first, the other requirements more logically follow.

Paragraph (c) of this section in the ANPRM proposed to determine the minimum speed in level flight. Several commenters question the need for this information, and one commenter states that it would take a significant amount of flight test at a major cost burden. The FAA agrees, and that portion of the proposal has been removed.

Paragraph (c) now contains a requirement to determine hover out-of-ground effect (HOGE) performance. (HOGE is hovering at a height greater than approximately one rotor diameter above the surface.) This is supported by comments made at the public meeting and in written comments. HOGE performance information is routinely determined and included in the Rotorcraft Flight Manual (RFM); therefore, there would be only a negligible increase in type certification testing costs.

A commenter questions whether HOGE controllability (controllable in 17-knot winds from any direction) should also be considered. Past FAA policy has permitted HOGE performance to be presented in zero wind if a minimum of yaw control remains (i.e., must be able to generate a positive yaw rate) or to be demonstrated with some wind condition if the demonstrated conditions are clearly identified in the RFM. The validity of this policy has been borne out by good service experience; therefore, the 17-knot criteria are not considered necessary in determining HOGE controllability.

One commenter suggests that OEI hover performance, both in and out-of-ground effect, should be required since it is "operationally significant." This information may be desirable for a few specific operations; however, since determining it would add hazardous and significant flight test time, an OEI hover performance information requirement is not proposed.

In proposed §§ 29.49 (a)(1) and (b)(1), the phrase "on each engine," which is specified in the current requirement, would not be included with the takeoff power requirement because some rotorcraft have takeoff power limited by parts of the drive system other than the engine. To specify takeoff power "on each engine" would needlessly restrict approval of these designs.

Present § 29.73(b)(2) establishes a minimum hover performance requirement for Category B helicopters that would be eliminated by this proposal. As an example, the maximum gross weight of an early design helicopter at sea level standard temperature could be increased 2,250 pounds above the present 20,000-pound limit if the parameters of a 2,500-foot altitude and a standard temperature plus 40 °F were removed as factors in establishing maximum gross weight. On the other hand, a helicopter that uses engines and drive systems where a constant power can be maintained throughout the altitude and temperature band of this section would be affected only slightly by either the present requirement or the proposal to eliminate it. The present limitation is, therefore, considered unnecessary for a transport helicopter. One commenter responded to this proposal and supports this change.

Section 29.51

This proposal would change the referenced sections in the introductory text of paragraph (a) to those applicable to this proposed revision. No comments were received on this proposal.

Section 29.53

The present description of the critical decision point (CDP) contained in § 29.53(b) would be clarified in a proposed new § 29.55; therefore, this description has been moved to proposed § 29.55. The other proposed paragraph redesignations in § 29.53 are editorial changes only. No comments were received on this proposal.

New § 29.55

This proposed new section would redefine CDP. The proposed new definition clarifies the objectives of the flight requirements. It would further remove the requirement to use both height and airspeed to define the CDP, as height alone may be sufficient. The proposal would also permit parameters other than height and airspeed to be used to designate the CDP. A commenter suggests using height instead of altitude in paragraph (b) to agree with other sections. The FAA agrees, and the comment has been incorporated into the proposal.

Section 29.59

This proposed revision would move the rejected takeoff requirements to a new § 29.62 and more clearly define the takeoff path from the start of the takeoff to completion at 1,000 feet above the takeoff surface. It would also describe the actions permitted and flight path for certification in accordance with the procedures and limits that have been established during previous certifications. In this respect, adoption of the proposal would not change present practice. The most significant proposed change would be to establish minimum climb gradients during the

takeoff path. Present requirements specify only a rate of climb. For a given rate of climb, as airspeed increases, the gradient of climb decreases. This makes it extremely difficult to analyze possible heliport sites for satisfactory obstacle clearance planes during departure. Additionally, if minimum gradients are adopted, there is more assurance that deviations from optimum flight path control do not result in a descent below a safe altitude during the continued takeoff.

Consideration has previously been given to establishing gross gradients and reducing them by some amount to a minimum net gradient to provide for turbulence and nonoptimum path control, but sufficient data could not be found to justify a specific increment. Therefore, the gradients are related to the present climb requirements but in some circumstances may require a higher level of performance.

With regard to proposed paragraphs (d) and (e), requirements in other parts of the FAR define the second segment of the takeoff path for airplanes as being from the end of the takeoff distances (35 feet above the takeoff surface) to 400 feet above the takeoff surface. Past industry practice has established the end of the helicopter takeoff second segment as 100 feet above the takeoff surface, and this height was proposed in the ANPRM. However, there was considerable discussion on the safety of using 100 feet for acceleration from V_{TOSS} (takeoff safety speed for Category A rotorcraft) to V_Y (speed for best rate of climb), especially at night in instrument meteorological conditions. The 100-foot height has no basis in past or present rules, and the current OEI climb requirements are at takeoff altitude and 1,000 feet above the takeoff surface. A major factor in determining where this second segment end point should be is the OEI engine ratings. While the present 2½-minute OEI engine limits and the 100-foot takeoff point are compatible, raising this height to 400 feet would not be compatible with either the 2½-minute engine rating or the 30-second and 2-minute engine ratings which are also being considered for rulemaking.

After careful consideration of all the arguments, the FAA is proposing to increase the second segment end point to 200 feet above the takeoff surface. This would provide an increase in the measure of safety necessary for the accelerations from V_{TOSS} to V_Y while remaining compatible with present and proposed engine ratings.

Several commenters question the proposal in the ANPRM to permit descent to no less than one-half the height of the CDP or height for first action to land after critical engine failure at CDP. One commenter states that rotorcraft configuration may be a more significant factor in determining allowable height loss. The British standards do not permit a descent if the CDP is less than 35 feet and permit no descent below 35 feet when the CDP is above 35 feet (British standard takeoff distance is determined at 50 feet for all category rotorcraft). In general, the commenters indicate that the takeoff path should be evaluated during certification flight tests and recommend no specific requirement on descent limits. One commenter states that a no-descent-height limit does not seem compatible with the balked landing requirement not to descend below 35 feet. Evaluation of the takeoff path during certification flight tests is a more valid procedure than the use of some arbitrary limiting height. Therefore, this limitation on the flight path has been removed from the normal Category A takeoff proposal and also from the pinnacle takeoff and balked landing proposals.

Another commenter suggests that a final paragraph referring to determining takeoff distance in accordance with § 29.61 should be added. The FAA agrees, and a new paragraph (f) has been added to the proposal.

As briefly discussed in the ANPRM, gross takeoff path was not reduced by some percent to a net path as airplane-related FAR do, because there are no data to define what the margin should be or if it is needed at all for rotorcraft. One commenter, supplying information on fixed-wing aircraft, suggests that rotorcraft should be comparable. The commenter further suggests that a 1.0 percent climb gradient margin between gross and net should be used and that, in so doing, this would raise the rate of climb requirement to 200 feet per minute at the takeoff surface. A second commenter opposes the gross-net concept stating that it is unnecessary, not historically shown to be needed, and that it would impose a significant cost/performance penalty. The FAA agrees, and the gross-net concept is not proposed in this NPRM.

The ANPRM proposal defined the end of the takeoff path as either 1,000 feet or the altitude after completion of the change to en route configuration. One commenter notes that rotorcraft do not require significant configuration changes and that the phrase "altitude after * * * configuration" should be removed. The FAA agrees, and the phrase has been removed from the new proposal.

Another commenter questions the limitation on which controls may be used in the initial climb. The commenter further states that the limits might be reasonable for a single-pilot aircraft, but that a second pilot should be allowed to operate any controls. Another commenter parallels the previous comment and further suggests that each rotorcraft should be assessed with regard to what and where the controls are and what the pilot workload and minimum crew are to determine if secondary controls may be used. Past FAA practice has been that, even with two pilots, only primary controls may be used until the aircraft is well above the takeoff surface. A history of repeated incident reports shows that incorrect flightcrew actions are taken in the immediate excitement after a failure. The relatively small gain in performance from immediate flightcrew action does not outweigh the results of an incorrect action, especially in the takeoff flight regime. Automatic controls have been approved on transport airplanes to feather a propeller or to advance throttles, but these are set up before takeoff is started and, again, the flightcrew uses only a primary control until at least 400 feet above the takeoff surface. Therefore, the wording as proposed in the ANPRM has been retained.

A user is concerned about the climb gradient being required for operational use but with insufficient information or instrumentation for the pilot to comply with the requirements. While this requirement is for a minimum performance certification, climb performance must be considered during operations whether the performance is measured by a rate of climb or a climb gradient. Wind will alter the operational climbout path no matter how the performance is measured during certification, and this should be considered during operations.

Very simply calculated (i.e., with zero wind, instantaneous airspeed changes, etc.), the proposed climb gradients mean that a rotorcraft would be at 1,000 feet approximately 7.6 nautical miles from the end of the first takeoff segment. If only the present rates of climb are required, different airspeeds would significantly influence the distance required to obtain 1,000 feet (e.g., a climb at a constant 40 knots would require about 4.6 nautical miles to reach 1,000 feet, while climbs at 75 and 100 knots would require about 8.7 and 11.6 nautical miles). As another example, a contemporary Category A rotorcraft that has a V_{TOSS} of 52 knots indicated airspeed (KIAS) and a sea level V_Y OEI of 76 knots would require about 8.2 nautical miles to obtain 1,000 feet above

the takeoff point if it were loaded to just meet the rate of climb requirements. This rotorcraft would therefore have to reduce gross weight slightly to obtain the 1,000 feet within the 7.6 nautical miles resulting from the climb gradient of this proposal. Further, the gradients proposed in this NPRM would provide one of the measures to be used in establishing the suitability of an area as a heliport and its compatibility with different rotorcraft.

New § 29.60

The requirements for a pinnacle (e.g., rooftop) takeoff were first used in 1961. Infrequent use of these requirements has resulted in few refinements. The infinite possibilities for different physical characteristics of pinnacle heliports have further complicated the task of defining the requirements for general application. Where the authorized takeoff and landing area encompasses the entire pinnacle top with no fences or horizontal nets, the pinnacle concept is relatively straightforward. Fences or horizontal obstacles at the edge immediately complicate certification. The proportions of an approved takeoff and landing area as a small area in the middle of a large rooftop, for example, could be such that it would no longer be considered a pinnacle. The proposed requirements would provide a generalized pinnacle concept while recognizing that there would have to be an operational evaluation of specific pinnacle heliports.

To be consistent with the normal Category A takeoff, the end of the second segment of the takeoff path has been increased to 200 feet above the takeoff surface from the 100 feet proposed in the ANPRM.

Discussion and comments indicate that when the rotorcraft descends below the takeoff surface, a simple clearance of 15 feet has proven satisfactory and is proposed in this NPRM rather that the 15-foot vertical and 35-foot horizontal clearance distances that were used in the past and proposed in the ANPRM.

One commenter questions why the takeoff path extends to 1,000 feet above the takeoff surface since that may be significantly above ground level. The reason that the takeoff path continues to 1,000 feet is to provide a measure of minimum required performance. Past policy permitted 200 feet above the takeoff surface or 1,000 feet above the surrounding surface, whichever was higher. This was dependent on the characteristics of the specific heliport used. Use of 1,000 feet above the takeoff surface is compatible with other takeoff procedures and provides a specific certification requirement that is not dependent on one heliport. It is not intended that the aircraft taking off would be required to climb to 1,000 feet above the takeoff surface before proceeding to the en route altitude even though each must have that capability.

As noted in the normal Category A takeoff proposal, the descent limit or clearance height above the takeoff surface is also not included in the pinnacle procedure.

While it was suggested that the normal takeoff rate of climb at the takeoff surface should be 200 feet per minute with the gross-net factors discussed earlier, the FAA rejects the suggestion for the same reasons of significant economic penalty and lack of proven necessity.

New § 29.61

This proposal would add a new section to define the parameters to be used in determining takeoff distance. The height of 50 feet above the takeoff surface was proposed in the ANPRM, in part, to be compatible with the British standard. However, several commenters object stating that the use of 50 feet would do nothing but extend the takeoff distance, thus, requiring larger heliports and, in general, causing an unnecessary economic burden on the industry. The FAA agrees, and the height will remain at the present 35 feet.

The ANPRM also proposed a second paragraph to define the takeoff distance as 1.15 times the demonstrated distance for a case where the takeoff path is the same with or without an engine failure. Although the current airplane takeoff distance determination includes the 1.15 distance, a commenter states that this is not applicable to rotorcraft. After further review, the FAA agrees, and the requirements of paragraph (b) of the ANPRM have been removed.

The various takeoff paths possible with rotorcraft (i.e., a CDP above or below 35 feet and descent during acceleration to V_{TOSS}) dictate requirements of more than just achieving a specified height to determine takeoff distance. The requirement to establish a positive rate of climb has been used on some previous certifications. Attainment of V_{TOSS} is not sufficient to define the end of the initial takeoff because the rotorcraft may still descend while changing the attitude from accelerating to climbing. Therefore, the following conditions define a completed takeoff and are included in the proposal: (1) Attaining and remaining above a specified altitude above the takeoff surface; (2) attaining a speed of at least V_{TOSS}; and (3) establishing a positive rate of climb.

New § 29.62

This proposal would separate the rejected takeoff criteria from the takeoff path section (§ 29.59) and restrict the use of controls to primary controls while airborne. This has been an accepted procedure but it is not clear in the present requirements. The proposed paragraph (d) has been divided into two sentences for clarification.

One commenter suggests that the pinnacle takeoff path (§ 29.60) should be referenced in addition to the normal takeoff path (§ 29.59). The FAA agrees, and this reference has been added.

A second commenter questions whether it is realistic to assume that an engine failure and the CDP are coincidental. Although a differentiation between airspeed at engine failure and the takeoff decision speed is made in transport airplane certification, a similar concept has not been used in rotorcraft certification. This question was also examined during the Rotorcraft Regulatory Review Program, specifically NPRM No. 82–12 (47 FR 37806, August 26, 1982), where it was noted that the distance between engine failure and decision points are considerably less for rotorcraft than for transport airplanes. Also noted was that pilot recognition time for engine failure is normally much shorter in rotorcraft. Therefore, the proposed § 29.62(a) will still require the critical engine to be failed at the CDP.

New § 29.64

This proposed new section would relocate the general conditions from each climb requirement and establish them in one new station. It would also add the requirement that the all-engine climb be evaluated at the most unfavorable center of gravity. The proposal would also clarify that climb performance must be determined for all rotorcraft throughout the allowable flight envelope. This has been FAA and industry practice, but it is not specifically contained in the FAR. No comments were received on this proposed new section.

Section 29.65

This proposal is to move the general conditions from present § 29.65 to a proposed new § 29.64. Additionally, this would delete the current requirement to determine Category A helicopter climb performance only when V_{NE} (never-exceed speed) is less than V_Y at sea level standard conditions with maximum weight and maximum continuous power. This requirement is confusing and has not been a certification factor since climb

performance has been obtained at all weights, altitudes, and temperatures.

Commenters question the necessity of the statement in paragraph (a)(3) that the applicant selection of climb speed must be at or below V_{NE} at other than sea level. The FAA agrees, and it has been removed.

Commenters also question the requirement to identify V_Y and the rate of climb at standard sea level conditions. This requirement is necessary to provide the pilot with the information of best climb capability even where some flight characteristic might make another airspeed the preferred speed for routine operations.

Section 29.67

This proposal would move the general requirements now contained in this section to new § 29.64. Most significantly, the proposal would establish minimum steady gradients of climb for each portion of the takeoff requirements. The proposal would also specify that the OEI rate of climb without ground effect, in takeoff conditions, is to be determined 200 feet above the takeoff surface. The approved operating limitations for engine power at this point should be those expected during the takeoff, as noted in § 29.59. Consequently, if the 2½- and 30-minute ratings are approved, the 2½-minute power could be used; however, if 30-second, 2-minute, and continuous ratings are approved, the 30-second power could not be used, but the 2-minute power rating could be.

The ANPRM proposed to limit the operative engine(s) to maximum continuous power both for the climb requirement at 1,000 feet above the takeoff altitude (at the end of the takeoff path) and when determining OEI climb performance at any altitude. This would have removed the present requirement that permits use of 30-minute power. All commenters object to removing the use of 30-minute power, stating that it would be economically disastrous for the industry. The use of 30-minute power has been retained in the NPRM for meeting the climb requirement at the end of the takeoff path. The term "maximum continuous power"is intended to include any new OEI maximum continuous rating. The use of time-limited power at the end of the takeoff path assumes that the rotorcraft can return and land at the takeoff point (or a nearby point) within the time specified by the rating.

New § 29.73 (Withdrawn)

The ANPRM discussed the possibility of proposing a new § 29.73 to determine en route capability with one engine inoperative. Those data are now adequately covered by the OEI climb requirements in the proposed revision to § 29.67; therefore, a new § 29.73 is not being proposed. (See the proposal for a new § 29.49 regarding the proposed redesignation of present § 29.73.)

Section 29.75

This section would separate the overall general landing requirements from the specific requirements and would provide a reference to proposed new sections for specific landing requirements. No comments were received on this proposal.

Section 29.77

Although not in the current rule, designation of a landing decision point (LDP) has been required in all recent Category A certifications. This proposal would add the requirement to the rule. No comments were received on this proposal.

Section 29.79

This proposal would establish the Category A landing requirements as a separate section. There would be no significant change from the present requirements. One commenter states that there is no provision for maximum landing weight to differ from maximum takeoff weight; therefore, landing data should be determined for each weight, altitude, and temperature for which takeoff data are approved. Although maximum structural takeoff and landing weights may be the same, the landing distance is usually shorter than the OEI takeoff distance, so at the same altitude and temperature and a given helipad size, greater weights may be landed than permitted for Category A takeoff. The comment, if adopted, would limit landing data (and therefore the landing operation) to weights no more than the approved takeoff weight for that altitude and temperature. This would be unduly restrictive, especially for a helicopter which may land, offload, and then takeoff at a significantly lower weight; therefore, this proposed section remains unchanged.

New § 29.81

This proposal would clearly establish the requirement to determine landing distances from specific heights in a new section. The proposed heights have been used in all recent Category A certifications but are not contained in the present rule. This proposal is the same as that proposed by the ANPRM except that the reference to vertical landing has been removed. That was the only place it was used and, because it was not explained or defined, the reference is neither necessary nor appropriate to this proposal.

New § 29.83

This proposal would move the Category B landing requirement into a new section. It would also change the landing procedures from power off to power on. A power-off landing is not a normal landing procedure but it is an emergency procedure where the operator uses whatever landing area is available. In general, the power-off landing distance will be longer than the power-on landing. Using the longer power-off distance to determine landing capability could unnecessarily penalize the operator.

New § 29.85

In this proposal, present § 29.77 would be redesignated as a new § 29.85 and paragraph (b) would be changed to specify the relationship between the landing decision point and a balked landing. There would be no significant change from the present requirement. The present paragraph (c) requirement not to descend below 35 feet was adopted in Amendment 29–24 to agree with the takeoff practice of limiting descent to one-half of the height of the CDP. Since this notice proposes to change the takeoff requirement, the balked landing requirement would be similarly changed not to specify a descent limit and to let certification flight tests define the procedures to be used during a go-around.

New § 29.87

The proposal would redesignate present § 29.79 as a new § 29.87 and remove the phrase "power failure conditions" since it may be confusing. Also, during recent type certification programs, it was found that for some rotorcraft, practical and safer takeoff profiles have been developed using less than full power, as specified in the present standard. This proposed section has been revised to clarify the power conditions to be used.

The commenters generally endorse the proposal to remove the requirement for determining a limiting Category A HV envelope by substituting critical velocity-altitude combinations, so called "abused" takeoff procedures, during Category A takeoff testing. However, the FAA has determined that the HV envelope must remain a limit for Category A and any rotorcraft with 10 or more seats. This is necessary because these aircraft must avoid the HV envelope at all times, not just during takeoff. There was general support for the proposal that multiengine Category

B rotorcraft meet the HV requirements with failure of only one engine when Category A engine isolation is demonstrated. The proposal in these respects is unchanged.

The title of the section would be changed from "Limiting height-speed envelope" to "Height-velocity envelope" to agree with the commonly used term.

A commenter submitted a review of the various factors that affect the HV envelope. The review included the following comments:

1. The safe takeoff and landing paths, the HV envelope requirements, and the requirement for all rotorcraft to be able to make a power-off landing should be separate requirements.

The FAA agrees, and this NPRM separates these requirements.

2. Takeoff and landing path requirements that state that a safe landing can be made after a power failure should appear in general paragraphs.

Takeoff path requirements that were proposed for this section in the ANPRM have been removed. Landing path requirement proposals have been expanded and clarified.

3. The flight manual should show the HV envelope for each altitude and temperature, the high and low hover points, and the knee velocity and height for all approved weights. The HV envelope should be determined with no wind, total power loss for all helicopters, and for Category A helicopters for critical engine failure.

The last sentence of the recommendation implies that a Category A helicopter would have two HV envelopes, one associated with total power loss and a second associated with loss of the critical engine. Since Category A was established, the FAA has not required an HV envelope with total power loss and there is no service history to indicate this should be changed. The commenter appears to want to pin down HV envelopes precisely for an extreme range of variables. This would be enormously expensive, hazardous, and not warranted from previous history. When all of the variables are considered and then compared to the information the operational pilot has available, the HV envelope can be no more than a guide. As brief examples, consider the accuracy and readability of the standard altimeters and airspeed systems at these low heights and speeds. Accordingly, the height-velocity envelope for complete power failure is proposed only for rotorcraft not meeting Category A engine isolation requirements. A requirement for multiple, precise HV envelopes is not included.

Another commenter contends that a multiengine helicopter with Category A engine isolation need not meet all the other structure and system Category A requirements to permit use of a single-engine failure HV envelope. Paragraph (c) of the ANPRM could be interpreted to propose that an HV envelope for complete power failure is required unless all Category A requirements are met. The FAA agrees with the comments, and a change has been made to indicate that only multiengine rotorcraft without engine isolation must accomplish the complete power failure HV envelope tests. This requirement was proposed in paragraph (c) of the ANPRM, and it is included in paragraph (b) of this NPRM because the FAA has determined not to propose the requirements set forth in paragraph (b) of the ANPRM for consideration of "abused" takeoff and landing profiles. The changes to § 29.1517 described in the ANPRM are also not being proposed because the FAA has determined that they require further evaluation.

Section 29.1323

This proposal would change the term limiting height-speed to height-velocity and the section reference from § 29.79 to § 29.87 to conform to this proposed revision. There were no comments on this proposal.

Section 29.1587

The sections referenced in paragraph (a) would be changed to agree with this proposed revision. The word "glide" would be removed from paragraph (b)(3) to indicate the power-on landing change in proposed new § 29.83. No comments were received on this proposal.

Regulatory Evaluation Summary

This is a summary of the preliminary cost and benefit impact evaluation for this notice. These proposals would revise existing standards and adopt some new standards of performance for part 29 rotorcraft certification. Twenty-one changes are proposed in this notice.

The proposed revisions to the regulations governing rotorcraft certification would affect primarily newly certificated rotorcraft. When manufacturers submit applications for type certification for transport category rotorcraft, they have 5 years to develop aircraft that meet all of the requirements of part 29 and amendments to that part, up to the date of application. It is expected that these proposed changes will become effective in 1990; thus, manufacturers will be first affected by these changes in 1990. Rotorcraft required to meet these changes are not likely to be produced before 1995.

All of the proposed changes are found to have negligible or no cost impacts. Most of the proposed changes are either editorial or would bring the regulations up to date with current technology. Four requirements imposed by the changes have been analyzed separately because they represent substantive changes in certification requirements and procedures. Two of these requirements affect § 29.49 (Performance at Minimum Operating Speed), one affects § 29.59 (Takeoff Path; Category A), and one affects § 29.83 (Landing; Category B). Results of this analysis show that these requirements will have negligible or no cost impact.

Taken as a whole, the proposed changes will:

(a) Marginally increase safety—by specifying OEI minimum climb gradients for Category A rotorcraft and by requiring power-on landing distance and HOGE information for Category B rotorcraft.

(b) Update and standardize certification requirements—by making the FAR consistent with current certification procedures.

International Trade Impact Analysis

The certification cost that may be imposed by these proposals will not result in a competitive trade disadvantage or advantage for U.S. manufacturers in domestic or foreign markets. This conclusion is based on the fact that foreign manufacturers must comply with the certification standards of part 29 as a condition of entry into the U.S. market which is the largest segment of their export market. Foreign and U.S. manufacturers are expected to pass the new certification costs on to consumers in domestic and foreign markets.

Regulatory Flexibility Determination

The FAA has determined that, under the criteria of the Regulatory Flexibility Act (RFA) of 1980, the amendments to part 29 proposed in this NPRM, at promulgation, would not have a significant economic impact on a substantial number of small entities. The RFA requires agencies to specifically review rules which may have a "significant economic impact on a substantial number of small entities." The FAA has adopted criteria and guidelines for rulemaking officials to apply when determining if a proposed or existing rule has a significant economic impact on a substantial number of small entities. The FAA small entity size standards criteria define a small helicopter manufacturer as an independently owned and managed firm having fewer than 75 employees. None

of the three manufacturers subject to the proposed changes to part 29 have fewer than 75 employees. Accordingly, the amendments to part 29 contained in this proposed rule would not affect any small entities.

Federalism Implications

The regulations proposed herein would not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this proposal would not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this proposed regulation is not major under Executive Order 12291. In addition, the FAA certifies that these proposals, if adopted, will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. All proposed changes are found to have negligible or no cost impacts. Small entities are not affected because transport rotorcraft are manufactured by large entities and trade is not affected since foreign manufacturers also must comply with the requirements of part 29. This proposal is considered to be nonsignificant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). An initial regulatory evaluation of the proposals, including a Regulatory Flexibility Determination and Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under "FOR FURTHER INFORMATION CONTACT."

List of Subjects in 14 CFR part 29

Air transportation, Aircraft, Aviation safety, Rotorcraft, Safety.

The Proposed Amendment

In consideration of the foregoing, the Federal Aviation Administration proposes to amend part 29 of the Federal Aviation Regulations (14 CFR part 29) as follows:

PART 29—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

1. The authority citation for part 29 continues to read as follows:

Authority: 49 U.S.C. 1344, 1354(a), 1355, 1421, 1423, 1424, 1425, 1428, 1429, 1430; 49 U.S.C. 106(g) (Revised Pub. L. 97-449, January 12, 1983).

2. Section 29.1 is amended by revising paragraph (e) to read as follows:

§ 29.1 Applicability.

* * * * *

(e) Rotorcraft with a maximum weight of 20,000 pounds or less but with 10 or more passenger seats may be type certificated as Category B rotorcraft provided the Category A requirements of §§ 29.67(a)(2), 29.87, 29.1517, and subparts C, D, E, and F of this part are met.

§ 29.73 [Redesignated as § 29.49]

3. Present § 29.73 is redesignated as a new § 29.49, and revised to read as follows:

§ 29.49 Performance at minimum operating speed.

(a) For each Category A helicopter, the hovering performance must be determined over the ranges of weight, altitude, and temperature for which takeoff data are scheduled—

(1) With not more than takeoff power;

(2) With the landing gear extended; and

(3) At a height consistent with the procedure used in establishing the takeoff, climbout, and rejected takeoff paths.

(b) For each Category B helicopter, the hovering performance must be determined over the ranges of weight, altitude, and temperature for which certification is requested, with—

(1) Takeoff power;

(2) The landing gear extended; and

(3) The helicopter in ground effect at a height consistent with normal takeoff procedures.

(c) For each helicopter, the out-of-ground effect hovering performance must be determined over the ranges of weight, altitude, and temperature for which certification is requested, with takeoff power.

(d) For rotorcraft other than helicopters, the steady rate of climb at the minimum operating speed must be determined over the ranges of weight, altitude, and temperature for which certification is requested, with—

(1) Takeoff power; and

(2) The landing gear extended.

4. Section 29.51 is amended by revising the introductory text of paragraph (a) to read as follows:

§ 29.51 Takeoff data: General.

(a) The takeoff data required by §§ 29.53, 29.55, 29.59, 29.60, 29.61, 29.62, 29.63, and 29.67 must be determined—

* * * * *

§ 29.53 [Amended]

5. Section 29.53 is amended by removing paragraph (b); by removing the paragraph designation "(a)" from paragraph (a) introductory text; and by redesignating present paragraphs (a)(1) and (a)(2) as (a) and (b), respectively.

6. A new § 29.55 is added to read as follows:

§ 29.55 Critical decision point: Category A.

(a) The critical decision point (CDP) is the last point in the takeoff path at which a rejected takeoff is assured within the distances determined under § 29.62 and is the first point at which a continued takeoff capability is assured under § 29.59.

(b) The CDP must be established in relation to the takeoff path using no more than two parameters, such as airspeed and height, to designate the CDP.

7. Section 29.59 is revised to read as follows:

§ 29.59 Takeoff path: Category A.

(a) The takeoff path extends from the point of commencement of the takeoff procedure to a point at which the rotorcraft is 1,000 feet above the takeoff surface and compliance with § 29.67(a)(2) is shown. In addition—

(1) The takeoff path must remain clear of the height-velocity envelope established in accordance with § 29.87;

(2) The rotorcraft must be flown to the critical decision point, at which point the critical engine must be made inoperative and remain inoperative for the rest of the takeoff;

(3) After the critical engine is made inoperative, the rotorcraft must attain V_{TOSS};

(4) Only primary controls may be used while attaining V_{TOSS} and while establishing a positive rate of climb. Secondary controls which are located on the primary controls may be used after a positive rate of climb and V_{TOSS} are established but in no case less than 3 seconds after the critical engine is made inoperative; and

(5) After attaining V_{TOSS} and a positive rate of climb, the landing gear may be retracted.

(b) During the takeoff path determination made in accordance with

paragraph (a) of this section and after attaining V_{TOSS} and a positive rate of climb, the climb must be continued at a speed as close as practicable to, but not less than, V_{TOSS} until the rotorcraft is 200 feet above the takeoff surface with not less than the climb performance required by § 29.67(a)(1).

(c) Between the point at the end of the takeoff distance established under § 29.61 and the point that the rotorcraft is 200 feet above the takeoff surface, the steady gradient of climb must not be less than 3.0 percent.

(d) From 200 feet above the takeoff surface, the rotorcraft takeoff path must be level or positive until a height 1,000 feet above the takeoff surface is attained with not less than the rate of climb required by § 29.67(a)(2). Any secondary or auxiliary control may be used after attaining 200 feet above the takeoff surface.

(e) From the point along the takeoff path at which the rotorcraft is 200 feet above the takeoff surface until it is 1,000 feet above the takeoff surface, the steady gradient of climb may not be less than 2.0 percent.

(f) Takeoff distance will be determined in accordance with § 29.61.

8. A new § 29.60 is added to read as follows:

§ 29.60 Pinnacle takeoff path; Category A.

(a) The pinnacle takeoff path extends from the point of commencement of the takeoff procedure to a point in the takeoff path at which the rotorcraft is 1,000 feet above the takeoff surface and the climb requirements of § 29.67(a)(2) are met. In addition—

(1) The requirements of § 29.59(a) must be met;

(2) While attaining V_{TOSS} and a positive rate of climb, the rotorcraft may descend below the level of the takeoff surface if, in so doing and when clearing the pinnacle edge, every part of the rotorcraft clears all obstacles by at least 15 feet; and

(3) The vertical magnitude of any descent below the takeoff surface must be determined.

(b) After attaining V_{TOSS} and a positive rate of climb, the landing gear may be retracted and the climb must be continued at a speed as close as practicable to, but not less than, V_{TOSS} until the rotorcraft is 200 feet above the takeoff surface with at least the climb performance required by § 29.67(a)(1).

(c) Between the point at the end of the takeoff distance established under § 29.61 and the point that the rotorcraft is 200 feet above the takeoff surface, the steady gradient of climb must not be less than 3.0 percent.

(d) From 200 feet above the takeoff surface, the rotorcraft takeoff path must be level or positive until attaining 1,000 feet above the takeoff surface. Any secondary or auxiliary control may be used after attaining 200 feet above the takeoff surface.

(e) From the point along the takeoff path at which the rotorcraft is 200 feet above the takeoff surface until it is 1,000 feet above the takeoff surface, the steady gradient of climb may not be less than 2.0 percent.

(f) Takeoff distance will be determined in accordance with § 29.61.

9. A new § 29.61 is added to read as follows:

§ 29.61 Takeoff distance; Category A.

The takeoff distance is the horizontal distance along the takeoff path required to attain and remain at least 35 feet above the takeoff surface, to attain and maintain a speed of at least V_{TOSS}, and to establish a positive rate of climb, assuming the critical engine failure occurs at the critical decision point.

10. A new § 29.62 is added to read as follows:

§ 29.62 Rejected takeoff; Category A.

The rejected takeoff distance and procedures for each condition where takeoff is approved will be established with—

(a) The takeoff path requirements of §§ 29.59 and 29.60 utilized up to the critical decision point, where the critical engine is failed and the rotorcraft is landed and brought to a stop on the takeoff surface;

(b) The remaining engines operating within approved limits;

(c) The landing gear remaining extended throughout the entire rejected takeoff; and

(b) The use of only the primary controls until the rotorcraft is on the ground. Secondary controls located on the primary control may not be used until the rotorcraft is on the ground. Means other than wheel brakes may be used to stop the rotorcraft if the means are safe and reliable and consistent results can be expected under normal operating conditions.

11. A new § 29.64 is added to read as follows:

§ 29.64 Climb: General.

Compliance with the requirements of §§ 29.65 and 29.67 must be shown at each weight, altitude, and temperature within the operational limits established for the rotorcraft and with the most unfavorable center of gravity for each configuration. Cowl flaps, or other means of controlling the engine-cooling air supply, will be in the position that provides adequate cooling at the temperatures and altitudes for which certification is requested.

12. Section 29.65 is amended by revising paragraph (a) to read as follows, and by removing paragraph (c):

§ 29.65 Climb: All engines operating.

(a) The steady rate of climb must be determined—

(1) With maximum continuous power;

(2) With the landing gear retracted; and

(3) At V_Y for standard sea level conditions and at speeds selected by the applicant for other conditions.

* * * * *

13. Section 29.67 is revised to read as follows:

§ 29.67 Climb: One engine inoperative.

(a) For Category A rotorcraft, in the critical takeoff configuration existing along the takeoff path, the following apply:

(1) The steady climb gradient without ground effect, 200 feet above the takeoff surface, must be not less than 3.0 percent or 100 feet per minute, whichever is greater, for each weight, altitude, and temperature for which takeoff data are to be scheduled with—

(i) The critical engine inoperative and the remaining engines within approved operating limitations;

(ii) The landing gear extended; and

(iii) The takeoff safety speed selected by the applicant.

(2) The steady climb gradient without ground effect must be not less than 2.0 percent or 150 feet per minute, whichever is greater, 1,000 feet above the takeoff surface for each weight, altitude, and temperature for which takeoff data are to be scheduled with—

(i) The critical engine inoperative and the remaining engines at maximum continuous power including OEI maximum continuous power, if approved, or at 30-minute power for helicopters for which certification for use of 30-minute power is requested;

(ii) The most unfavorable center of gravity for takeoff;

(iii) The landing gear retracted; and

(iv) The speed selected by the applicant.

(3) The steady rate of climb (or descent), in feet per minute, at any altitude and temperature at which the rotorcraft is expected to operate and at any weight within the range of weights for which certification is requested, must be determined with—

(i) The critical engine inoperative and the remaining engines at maximum continuous power including OEI maximum continuous power, if

approved, and at 30-minute power for helicopters for which certification for the use of 30-minute power is requested;

(ii) The landing gear retracted; and

(iii) The speed selected by the applicant.

(b) For multiengine Category B helicopters meeting the Category A engine isolation requirements, the steady rate of climb (or descent) must be determined at the speed for best rate of climb (or minimum rate of descent) at any altitude, temperature, and weight at which the rotorcraft is expected to operate, with the critical engine inoperative and the remaining engines at maximum continuous power including OEI maximum continuous power, if approved, and at 30-minute power for helicopters for which certification for the use of 30-minute power is requested.

14. Section 29.75 is amended by revising paragraphs (a) and (b) as follows and by removing paragraph (c):

§ 29.75 Landing: General.

(a) For each rotorcraft—

(1) The corrected landing data must be determined for a smooth, dry, hard, and level surface;

(2) The approach and landing must not require exceptional piloting skill or exceptionally favorable conditions; and

(3) The landing must be made without excessive vertical acceleration or tendency to bounce, nose over, ground loop, porpoise, or water loop.

(b) The landing data required by §§ 29.77, 29.79, 29.81, 29.83, and 29.85 must be determined—

(1) At each weight, altitude, and temperature for which landing data are approved;

(2) With each operating engine within approved operating limitations; and

(3) With the most unfavorable center of gravity.

§ 29.85 [Redesignated from § 29.77]

15. Present § 29.77 is redesignated as § 29.85, and a new § 29.77 is added to read as follows:

§ 29.77 Landing decision point; Category A.

The landing decision point (LDP) must be established at not less than the last point in the approach and landing path at which a balked landing can be accomplished under § 29.85 with the critical engine failed or failing at that point.

§ 29.87 [Redesignated from § 29.79]

16. Present § 29.79 is redesignated as § 29.87 and a new § 29.79 is added to read as follows:

§ 29.79 Landing; Category A.

(a) For Category A rotorcraft—

(1) The landing performance must be determined and scheduled so that if the critical engine fails at any point in the approach path, the rotorcraft can either land and stop safely or climb out and attain a rotorcraft configuration and speed allowing compliance with the climb requirement of § 29.67(a)(2);

(2) The approach and landing paths must be established with the critical engine inoperative so that the transition between each stage can be made smoothly and safely;

(3) The approach and landing speeds must be selected by the applicant and must be appropriate to the type of rotorcraft; and

(4) The approach and landing path must be established to avoid the critical areas of the height-velocity envelope determined in accordance with § 29.87.

(b) It must be possible to make a safe landing on a prepared landing surface after complete power failure occurring during normal cruise.

17. A new § 29.81 is added to read as follows:

§ 29.81 Landing distance; Category A.

The horizontal distance required to land and come to a complete stop (or to a speed of approximately 3 knots for water landings) from a point 50 feet above the landing surface (25 feet for Category A pinnacle landing operations) must be determined from the approach and landing paths established in accordance with § 29.79.

18. A new § 29.83 is added to read as follows:

§ 29.83 Landing; Category B.

(a) For each Category B rotorcraft, the horizontal distance required to land and come to a complete stop (or to a speed of approximately 3 knots for water landings) from a point 50 feet above the landing surface must be determined with—

(1) Speeds appropriate to the type of rotorcraft and chosen by the applicant to avoid the critical areas of the height-velocity envelope established under § 29.87; and

(2) The approach and landing made with power on and within approved limits.

(b) Each multiengine Category B rotorcraft that meets the powerplant installation requirements for Category A must meet the requirements of—

(1) Sections 29.79 and 29.81; or

(2) Paragraph (a) of this section.

(c) It must be possible to make a safe landing on a prepared landing surface if complete power failure occurs during normal cruise.

19. Newly redesignated § 29.85 is revised to read as follows:

§ 29.85 Balked landing: Category A.

For Category A rotorcraft, the balked landing path must be established so that—

(a) With the critical engine inoperative, the transition from each stage of the maneuver to the next stage can be made smoothly and safely;

(b) With the critical engine failing at the landing decision point on the approach path selected by the applicant, a safe climbout can be made at speeds allowing compliance with the climb requirements of § 29.67(a) (1) and (2); and

(c) The rotorcraft does not touch down. For pinnacle operations, descent may be below the landing surface provided the descent distance below the landing surface is determined.

20. Newly redesignated § 29.87 is revised to read as follows:

§ 29.87 Height-velocity envelope.

(a) If there is any combination of height and forward velocity (including hover) under which a safe landing cannot be made after failure of the critical engine and with the remaining engines (where applicable) operating within approved limits, a height-velocity envelope must be established for—

(1) All combinations of pressure altitude and ambient temperature for which takeoff and landing are approved; and

(2) Weight, from the maximum weight (at sea level) to the highest weight approved for takeoff and landing at each altitude. For helicopters, this weight need not exceed the highest weight allowing hovering out-of-ground effect at each altitude.

(b) For single-engine or multiengine rotorcraft not meeting the Category A engine isolation requirements, the height-velocity envelope for complete power failure must be established.

21. Section 29.1323 is amended by revising paragraph (b)(2)(ii) to read as follows:

§ 29.1323 Airspeed indicating system.

* * * * *

(b) * * *

(2) * * *

(ii) Avoidance of the critical areas of the height-velocity envelope as established under § 29.87.

* * * * *

22. Section 29.1587 is amended by revising paragraphs (a)(4), (a)(5), and (b)(3) to read as follows.

§ 29.1587 Performance information.

* * * * *

(a) * * *

(4) The rejected takeoff distance determined under § 29.62 and the takeoff distance determined under § 29.61 or § 29.63; and

(5) The landing data determined under § 29.81 or § 29.83.

(b) * * *

(3) The landing distance, appropriate airspeed, and kind of landing surface, together with any pertinent information that might affect this distance, including the effects of weight, altitude, and temperature;

* * * * *

Issued in Washington, DC, on January 2, 1990.

Thomas E. McSweeny,

Acting Director, Aircraft Certification Service.

[FR Doc. 90-354 Filed 1-5-90; 8:45 am]

BILLING CODE 4910-13-M