Federal Aviation Administration
Aviation Rulemaking Advisory Committee

Rotorcraft Issue Area
External Load Working Group

Task 1 – Class D Rotorcraft External Loads

Task Assignment

necessary in the public interest in connection with the performance of duties imposed on the FAA by law. Meetings of the full committee and any subcommittees will be open to the public except as authorized by section 10(d) of the Federal Advisory Committee Act. Meetings of the Occupant Restraint Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on November 27, 1991.

William J. Sullivan,

Executive Director, Rotorcraft Subcommittee, Aviation Rulemaking Advisory Committee.

[FR Doc. 91-29034 Filed 12-3-91; 8:45 am]

BILLING CODE 4910-13-M

Aviation Rulemaking Advisory Committee; Rotorcraft Subcommittee; External Load Working Group

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of establishment of External Loal Working Group.

SUMMARY: Notice is given of the establishment of an External Load Working Group by the Rotorcraft Subcommittee. This notice informs the public of the activities of the Rotocraft Subcommittee of the Aviation Rulemaking Advisory Committee.

FOR FURTHER INFORMATION CONTACT: Mr. William J. (Joe) Sullivan, Executive Director, Rotorcraft Subcommittee, Aircraft Certification Service (AIR-3), 800 Independence Avenue, SW., Washington, DC 20591, Telephone: (202) 267-9554; FAX: (202) 267-9562.

SUPPLEMENTARY INFORMATION: The Federal Aviation Administration (FAA) established an Aviation Rulemaking Advisory Committee (56 FR 2190, January 22, 1991) which held its first meeting on May 23, 1991 (56 FR 20492, May 3, 1991). The Rotorcraft Subcommittee was established at that meeting to provide advice and recommendations to the Director, Aircraft Certification Service, FAA, regarding the airworthiness standards for normal and transport category rotorcraft in parts 27 and 29 of the Federal Aviation Regulations. At its first meeting on September 25, 1991 (56 FR 33484, July 22, 1991), the subcommittee established the Occupant Restraint Working Group.

Specifically, the working group's task is the following:

Task: The External Load Working Group is charged with making a recommendation to the Rotorcraft Subcommittee concerning whether new or revised airworthiness standards are appropriate for Class D rotorcraft external loads, as follows; Should parts 27 or 29 be amended to incorporate Class D external load attaching means, to complement Amendment 133-9, which authorizes the transport of passengers external to the rotorcraft, which certain conditions and limitations.

Reports: The Working Group will develop any combination of the following as it deems appropriate:

1. A draft Notice of Proposed Rulemaking proposing new standards, supporting economic and other required analysis, with any other collateral documents the Working Group determines to be needed; or

2. A report stating the rationale for recommending against the adoption of new standards.

The working group will first develop a time line(s) for completion of this effort, and present it to the Subcommittee for approval at the next meeting. The working group chair or an alternate will make a status report at each meeting of the Rotorcraft Subcommittee.

The External Load Working Group will be comprised of experts from those organizations having an interest in the task assigned to it. A working group member need not necessarily be a representative of one of the organizations of the parent Rotorcraft Subcommittee or of the full Avaiation Rulemaking Advisory Committee. An individual who has expertise in the subject matter and wishes to become a member of the working group should write the person listed under the caption "**FOR FURTHER INFORMATION CONTACT**" expressing that desire, describing his or her interest in the task, and the expertise he or she would bring to the working group. The request will be reviewed with the subcommittee chair and working group leader, and the individual advised whether or not the request can be accommodated.

The Secretary of Transportation has determined that the information and use of the Aviation Rulemaking Advisory Committee and its subcommittees are necessary in the public interest in connection with the performace of duties imposed on the FAA by law. Meetings of the full committee and any subcommittees will be open to the public except as authorized by section 10(d) of the Federal Advisory Committee Act. Meetings of the External Load Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC on November 27, 1991.

William J. Sullivan,

Executive Director, Rotocraft Subcommittee, Aviation Rulemaking Advisory Committee.

[FR Doc. 91-29035 Filed 12-3-91; 8:45 am]

BILLING CODE 4910-13-M

National Highway Traffic Safety Administration

[Docket No. 91-51; Notice 1]

The Clarity Group, Inc.; Receipt of Petition for Temporary Exemption From Nine Federal Motor Vehicle Safety Standards

The Clarity Group, Inc., of Glendale, Arizona, dba Electric Transportation Applications, has applied for a temporary exemption from nine Federal motor vehicle safety standards for passenger cars and trucks that it converts to electric power. The basis of the petition is that an exemption will facilitate the development and field evaluation of low-emission motor vehicles.

Notice of receipt of the petition is published in accordance with agency regulations on the subject (49 CFR part 555), and does not represent any judgment of the agency on the merits of the petition.

Petitioner intends to convert 1992 model Ford Escort LX station wagons, and Chevrolet S10/GMC S15 pickup trucks to electric power. Petition is therefore made on the basis that a temporary exemption would facilitate the development and field evaluation of a low-emission motor vehicle, as provided by 49 CFR 555.6(c).

The vehicles to be converted have been certified by their original manufacturers to conform to all applicable Federal motor vehicle safety standards. However, petitioner has determined that the vehicles may not conform with all or part of nine Federal motor vehicle safety standards after their modification. The standards and sections for which exemptions are requested are discussed more fully below.

1. Standard No. 101, Control and Displays.

(a) S5.1: displays for fuel, engine coolant temperature, oil, and electrical charge.

(b) S5.3: illumination of controls and displays.

In the petitioner's view, these exemptions would not unreasonably

Recommendation Letter

Agency Action Item

7313 Janetta Dr., Fort Worth, TX 76180

MAR

Mr. Guy S. Gardner
Associate Administrator
for Regulation and Certification
Federal Aviation Administration
800 Independence Ave., S.W.
Washington, DC 20591

Dear Mr. Gardner:

The Aviation Rulemaking Advisory Committee (ARAC) Working Group activity associated with External Loads has been completed. The results of their efforts were submitted to ARAC for review. The ARAC examined those results at a public meeting on February 18, 1998, in Anaheim, California, and approved them.

Accordingly, the ARAC hereby submits the following material and recommends that the draft NPRM be processed for publication:

- Draft NPRM
- Executive Summary
- Preliminary Regulatory Evaluation, Regulatory Flexibility Determination and Trade Impact Assessment.

The Working Group also developed proposed Advisory Circular (AC) material. That material is being forwarded to the FAA Rotorcraft Directorate for further action since they have been delegated AC responsibility by FAA Order 8000.51. A copy of the draft AC material is enclosed for your information.

Very truly yours,

John D. Swihart, Jr.
ARAC Assistant Chair for Rotorcraft Issues

Enclosures

cc:
Mr. R. E. Robeson, Jr., ARAC Chair
Mr. Joseph Hawkins, ARAC Executive Director
Mr. Mark R. Schilling, ARAC Asst. Executive Director
Mr. Larry Plaster, Chair, External Loads Working Group
Mr. Glenn Rizner, HAI
Ms. Angela Anderson, FAA, ARM-200

Acknowledgement Letter

U.S. Department
of Transportation

**Federal Aviation
Administration**

800 Independence Ave., S.W.
Washington, D.C. 20591

APR 2 1998

Mr. John D. Swihart, Jr.
Aviation Rulemaking Advisory Committee
Helicopter Association International
7313 Janetta Dr.
Fort Worth, TX 76180

Dear Mr. Swihart:

Thank you for your March 12 letter forwarding the recommendations of the Aviation Rulemaking Advisory Committee (ARAC). The recommendations include a notice of proposed rulemaking (NPRM) concerning revisions of certain airworthiness standards for rotorcraft load combination certification and proposed revisions to a related advisory circular.

The complete rulemaking package will be reviewed and coordinated within the Federal Aviation Administration (FAA) and, if appropriate, the Offices of the Secretary of Transportation and Management and Budget. The FAA will publish the NPRM for public comment as soon as the coordination process is complete. The proposed revisions to the advisory circular will also be made available to the public for comment when the coordination is complete. We will make every effort to handle these recommendations expeditiously.

I would like to thank the aviation community for its commitment to ARAC and its expenditure of resources in the development of these recommendations. More specifically, I would like to thank the members of the External Loads Working Group for their commitment to the ARAC process and prompt action on these tasks.

Sincerely,

for Guy S. Gardner
Associate Administrator for
Regulation and Certification

Recommendation

[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 27 and 29

[Docket No. ; Notice No.]

RIN 2120-

Rotorcraft Load Combination Safety Requirements

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: This document proposes the amendment of the airworthiness standards for rotorcraft load combination (RLC) certification. This proposal would revise the safety requirements for RLC's to address advances in technology and to provide an increased level of safety in the carriage of humans. These proposed amendments would provide an improvement in the safety standards for RLC certification and lead to a harmonized international standard.

DATES: Comments must be submitted on or before [*insert date 180 days after date of publication in the* ***Federal Register***].

ADDRESSES: Comments on this notice may be delivered or mailed in triplicate to: Federal Aviation Administration (FAA), Office of the Chief Counsel, Attn: Rules Docket (AGC-200), Docket No. , Room 915G, 800 Independence Avenue, SW., Washington, DC 20591. Comments delivered must be marked Docket No. . Comments may also be sent electronically to the following internet address: nprmcmts@mail.hq.faa.gov. Comments may be examined in

Room 915G on weekdays between 8:30 a.m. and 5.00 p.m., except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Mr. Mike Mathias, Rotorcraft Directorate, Aircraft Certification Service, Regulations Group, FAA, Fort Worth, Texas 76193-0111, telephone (817) 222-5123.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to submit written data, views, or arguments on this proposed rule. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this notice are also invited. Substantive comments should be accompanied by cost estimates. Comments should identify the regulatory docket number and should be submitted in triplicate to the Rules Docket address specified above.

All comments received on or before the closing date for comments specified will be considered by the Administrator before taking action on this proposed rulemaking. Late-filed comments will be considered to the extent practicable. The proposals contained in this notice may be changed in light of the comments received.

All comments received, as well as a report summarizing each substantive public contact with FAA personnel on this rulemaking, will be filed in the docket.

The docket is available for public inspection before and after the comment closing date.

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 [Insert Docket No.]." The postcard will be date stamped and returned to the commenter.

Availability of NPRM's

An electronic copy of this document may be downloaded using a modem and suitable communications software from the FAA regulations section of the Fedworld electronic bulletin board service (telephone: 703-321-3339), the Federal Register's electronic bulletin board service (telephone: 202-512-1661), or the FAA's Aviation Rulemaking Advisory Committee Bulletin Board service (telephone: 800-FAA-ARAC).

Internet users may reach the FAA's web page at http://www.faa.gov or the Federal Register's web page at http://www.access.gpo.gov/su_docs for access to recently published rulemaking documents.

Any person may obtain a copy of this NPRM by submitting a request to the FAA, Office of Rulemaking, ARM-1, 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 NPRM's should request a copy of Advisory Circular No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedures.

History

For many years the design standards for external load attaching means for normal and transport category rotorcraft were contained in Subpart D, Airworthiness Requirements of 14 CFR part 133 (part 133), Rotorcraft External Load Operations. However, these design standards more appropriately belonged under parts 27 and 29. Amendments 27-11 (41 FR 55469, December 20, 1976) and 29-12 (41 FR 55454, December 20, 1976) added new §§ 27.865 and 29.865 and moved some of these design standards from the operational rules of part 133 to the certification rules of parts 27 and 29.

Rotorcraft-load combination classes (RLC) are defined in 14 CFR § 1.1. Part 133 prohibits the carrying of humans, except for crewmembers, external to the aircraft under all existing RLC's (A, B, or C). However, on April 5, 1978, Exemption No. 2534 was granted to permit carrying harbor pilots external to the rotorcraft using a hoist and sling.

Because of the proven public utility of the operations conducted with Exemption No. 2534, in January 1987, after notice and a public meeting, Amendment 133-9 (51 FR 40707, November 7, 1986) was adopted. Amendment 133-9 established provisions for a new Class D RLC for transporting external loads other than Classes A, B, or C. Class D may apply to either human or nonhuman external cargo operations; however, under Amendment 133-9, § 133.45(e) specifies that only certain Transport Category A rotorcraft can be used for RLC Class D external load operations. Also, Amendment 133-9 added § 133.35 to establish specific limitations and the necessary safety requirements for routine external load transportation under Class D.

Aviation Rulemaking Advisory Committee (ARAC) involvement

In 1991 the FAA requested that ARAC study the need to revise the regulations on RLC in light of advancements in technology and operational procedures and to develop regulatory recommendations. The ARAC was established on February 5, 1991 (56 FR 2190, January 22, 1991), to assist the FAA in the rulemaking process by providing advice from the private sector on major regulatory issues affecting aviation safety. The ARAC includes representatives of manufacturers, air carriers, general aviation, industry associations, labor groups, universities, and the general public. The ARAC's formation has given the FAA additional opportunities to solicit information directly

from significantly affected parties who meet and exchange ideas about proposed and existing rules that should be either created, revised, or eliminated.

On November 27, 1992, following an announcement in the Federal Register (56 FR 63546, December 4, 1991), the ARAC charged The External Load Working Group with making a recommendation to the ARAC concerning whether new or revised airworthiness standards are appropriate for Class D rotorcraft external loads, as follows: "Should parts 27 or 29 be amended to incorporate Class D external load attaching means, to complement Amendment 133-9, which authorizes the transport of passengers external to the rotorcraft, with certain conditions and limitations?"

The working group, chaired by a representative from McDonnell Douglas Helicopter Systems, included technical specialists knowledgeable in both military and civil external load operations, in external load and emergency rescue equipment design and manufacturing, and in both FAA and industry external load design and operational requirements. This broad participation is consistent with FAA policy to have all known interested parties involved as early as practicable in the rulemaking process.

The working group reviewed unpublished data regarding external loads safety issues developed by the FAA as the starting point for their discussions. After reviewing the unpublished data, the working group determined that it was

necessary to do further research and to include consideration of more diverse design configurations and operating procedures.

The working group reviewed current methods that the military and other nations' airworthiness authorities use to certificate aircraft conducting external load operations. The group also evaluated current operational practices with aircraft certificated in all categories and public aircraft operations involving human and nonhuman external loads. The working group researched available military and domestic safety standards and guidance, the accident and incident history of external load operations conducted under current certification standards, and the specific safety requirements necessary for human and nonhuman external load operations in each RLC class.

Technical Research

The following material was researched by the ARAC working group and contributed significantly to formulating these proposals. Copies may be found in Rules Docket No. [*Insert Rules Docket No.*].

1. United States Army Material Command (USA, AMC) Pamphlet No. 706-203, "Engineering Design Handbook Helicopter Engineering, Part Three, Qualification Assurance," Headquarters United States Army Material Command, Washington, D.C. 20315.

2. USAAVSCOM TR 89-D-22A, "Aircraft Crash Survival Design Guide; Volume IV - Aircraft Seats, Restraints, Litters, and Cockpit/Cabin Delethalization."

3. MIL-STD-882B, "Military Standard-System Safety Program Requirements," March 30, 1984.

4. MIL-STD-1472D, "Military Standard-Human Engineering Design Criteria for Military Systems, Equipment, and Facilities," March 14, 1989.

5. British Civil Airworthiness Requirements 29, Issue 1, December 17, 1986.

6. Advisory Circular 133-1A, "Rotorcraft External-Load Operations in Accordance with part 133," October 16, 1979.

7. "Rotorcraft Use in Disaster Relief and Mass Casualty Incidents-Case Studies," DOT/FAA/RD-90/10, June 1990.

8. "Guidelines for Integrating Helicopter Assets into Emergency Planning," DOT/FAA/RD-90/11, July 1991.

9. FAA Order 8700.1, "General Aviation Operations Inspector's Handbook" Chapter 96, Change 8, March 1, 1992.

The research centered on the following:

(1) Current methods used by the military to qualify external loads;

(2) Current methods used by the world's airworthiness authorities for certification of external loads;

(3) Current practice in restricted category and public use operations regarding human and nonhuman external load operations;

(4) Load retention and release devices that exist and are certifiable;

(5) Current military and domestic safety standards and guidance;

(6) Accident and incident history of external load operations that relate to the current certification standards; and

(7) Specific certification safety requirements that are necessary for human versus nonhuman external load operations.

Statement of the Issues

Although rotorcraft external load operations are routinely conducted in a safe manner under the existing safety standards, several preventable accidents and incidents have occurred during the preceding decade. For example, several preventable inadvertent releases of humans being carried external to the rotorcraft have occurred due to the lack of specific safety standards for quick-release systems (QRS). Additionally, the equipment employed in external load operations has changed significantly since the existing safety standards were promulgated. Examples of these equipment changes are more diverse, maneuverable, and powerful rotorcraft designs, new QRS designs, new

personnel carrying device systems (PCDS) designs, and new methods of rigging external loads to the rotorcraft.

Because of the need for both modernization and a higher level of safety, this proposal would address safety requirements for human external cargo (HEC) and nonhuman external cargo (NHEC); update load-to-vertical-angle certification requirements; add reliability and durability requirements for external load retention and release systems and devices; and add electromagnetic interference and lightning protection requirements because these items are not specifically addressed in the existing regulations.

In addition, this proposal would amend part 29 by adding new certification requirements that are compatible with the operating requirements of current part 133 for RLC Class D external loads. This proposal would provide a clearly specified certification safety standard for RLC Class D external loads in part 29. The change to part 29 would respond to increasing public demand for specific RLC Class D provisions that meet operational needs through standardized certification criteria.

Studies and analyses of service difficulty reports and the introduction of modern external load equipment and operational practices have shown a need for updating the regulations to (1) significantly decrease the potential for future accidents and incidents; (2) ensure that external cargo load carrying devices,

their release mechanisms, their load carrying systems, and their flight performance, reflect modern operational needs; and (3) provide updated standards that can be harmonized with the Joint Airworthiness Regulations (JAR).

Current Requirements

Currently, §§ 27.865 and 29.865 contain identical provisions and apply only to RLC Class A, B, and C loads at the gross weights and associated load factors common for relatively heavy NHEC loads. Primary and secondary quick-release devices are required; however, specific safety features and test and reliability requirements for the entire QRS are not specified. In-flight handling qualities and release (i.e., jettisonability) characteristics of NHEC and HEC are not currently addressed.

Part 29 Transport Category A rotorcraft are eligible under part 133 for Class D RLC operations. However, part 29 design standards do not exist for certification of Class D RLC's.

FAA Evaluation of ARAC Recommendation

After reviewing the External Load Working Group's work product and the ARAC recommendations, the FAA has determined that parts 27 and 29 should be revised to establish an increased margin of safety in rotorcraft external load operations. These revisions are necessary to implement modern safety

standards that accommodate current and anticipated operational RLC applications and procedures and provide separate levels of safety for NHEC and HEC RLC's. These new safety standards are more fully described in the **General Discussion of Proposals** section. These changes to parts 27 and 29 include the addition of: (1) increased load factors for HEC; (2) increased QRS safety standards for both NHEC and HEC; (3) new PCDS standards for HEC; (4) new flight-handling characteristic standards for both NHEC and HEC; (5) increased fatigue substantiation standards for both NHEC and HEC; and (6) to part 29 only, the RLC Class D standard. These improvements to the safety standards should prevent many accidents and incidents. The proposal would provide identical, improved external load standards for rotorcraft certificated under parts 27 and 29 and would provide RLC Class D certification standards under part 29.

General Discussion of Proposals

These proposals would provide essentially identical external load standards in parts 27 and 29. In addition, both the part 27 and 29 proposals would provide certification standards for all RLC's that are compatible with the operational requirements in part 133.

Proposed Amendments to §§ 27.25(c) and 29.25(c)

The proposed amendments to §§ 27.25 and 29.25 would limit the availability of increased gross weights to those RLC's that involve the carriage of nonhuman loads. For applications for certification with human loads, the applicant would be limited by subparagraph (c)(1) to the maximum weight established in §27.25(a). The changes would be a new limitation to reflect the distinction being made between those operations involving the carrying of humans externally for which a higher level of safety is needed.

Proposed Amendments to §§ 27.865 and 29.865

Because the proposed amendments would address more than just the attachment means for external loads, the undesignated center headings and the section titles of proposed §§ 27.865 and 29.865 would be changed from "External Load Attaching Means" to "External Loads."

Proposed Amendments to §§ 27.865(a) and 29.865(a)

The addition of new human external cargo certification requirements (HEC) and additional requirements for nonhuman external cargo (NHEC) certification results in modification of §§ 27.865(a) and 29.865(a). The most significant modification is a change in the current load factor specification to distinguish between and provide the required additional level of safety for HEC.

Current §§ 27.865(a) and 29.865(a) require the use of a 2.5g vertical limit load factor or a lesser value (derived from current §§ 27.337 through 27.341 or 29.337 through 29.341) at the maximum external load value for which certification is requested. This 2.5g limit load factor would be retained for NHEC applications in the proposals.

However, for HEC applications that are typically lower gross weight configurations, proposed §§ 27.865(a) and 29.865(a) contain a higher vertical limit load factor to be applied to the external load attachment and the entire attached PCDS. The higher vertical limit load factor is specified by these proposals as either the analytically derived maximum vertical limit load factor for the proposed operating envelope or a vertical limit load factor of 3.5 (derived from §§ 27.337 and 29.337). However, in no case would these proposals allow the maximum vertical limit load factor for HEC to be less than 2.5. Linear interpolation between minimum and maximum vertical design load factors and standard operating gross weight is one simple, acceptable means to determine design limit load factors.

Proposed §§ 27.865(a) and 29.865(a) would also require the limit static load for any RLC, either HEC or NHEC, to be determined and applied in both the vertical direction, and for jettisonable external loads in any direction, making the maximum angle that can be achieved in service (but not less than 30°) with the

vertical axis of the rotorcraft. The term "maximum angle that can be achieved in service" means the largest angle expected to occur during normal operation. This term is added to the vertical angle requirement to ensure that sidepull (or other) configurations used for jettisonable RLC applications, such as wire stringing, that typically involve angles greater than the current 30°, would be addressed at the time of certification. The current 30° angle requirement was established based on the rule-of-thumb design limit for winch or hoist applications typical when the rule was promulgated and applications using larger angles were unforeseen. The proposed rule would not change the 30° angle limitation for winch or hoist applications. The existing rule does not specifically address RLC applications such as sidepull configurations. These proposed section changes would more closely match the needed safety standards to the type of RLC operations in the industry.

Proposed Amendments to §§ 27.865(b) and 29.865(b)

The terms "quick-release system," "primary quick release subsystem," and "backup quick release subsystem" are substituted throughout proposed §§ 27.865(b) and 29.865(b) for the current terminology of quick-release device, primary quick-release device, and mechanical backup quick-release device to require certification of the entire QRS, not just the quick-release devices. The

proposals would also require that the primary and backup QRS be isolated from one another to ensure fail safety.

Also to facilitate harmonization with the Joint Aviation Authorities (JAA), the FAA proposes to delete the current references to RLC Classes B and C from §§ 27.865(b) and 29.865(b). These references are not necessary to the proposed new §§ 27.865(b) and 29.865(b) because the design distinctions necessary to provide the required level of safety would be made during certification without a need to refer to the operations based RLC classes. These distinctions are made by specifying whether or not an external load is jettisonable or non-jettisonable and whether or not an external load is human or non-human.

Proposed Amendments to §§ 27.865(b)(1) and 29.865(b)(1)

Proposed §§ 27.865(b)(1) and 29.865(b)(1) would allow the primary quick release control to be mounted either on a primary control or in any equivalently accessible location. This proposed change is intended to liberalize design options and allow a more realistic workload distribution among larger dedicated crews while maintaining the same level-of-safety. The proposals would allow the control to be operated by a crewmember without necessarily being reachable by the pilot. The rotorcraft's approved operating procedures must address the responsibilities and procedures for the control of the QRS.

Proposed Amendments to §§ 27.865(b)(2) and 29.865(b)(2)

Proposed §§ 27.865(b)(2) and 29.865(b)(2) would change the current requirement that the backup control for the quick-release device be only a manual mechanical control. These proposals would require that a backup quick release subsystem of an approved design be readily available to the pilot or other crewmember.

Proposed Amendments to §§ 27.865(b)(3)(i) and 29.865(b)(3)(i)

Because of adverse service history and the need to specifically distinguish the levels of safety for HEC and NHEC, proposed §§ 27.865(b)(3)(i) and 29.865(b)(3)(i) would require that both the primary and backup quick release subsystems be reliable, durable, and functional. Reliability would be demonstrated by use of design features and by use of failure modes and effects analysis. Both reliability and durability would be demonstrated by use of repetitive functional tests. These proposed reliability and durability criteria would apply only to newly modified or type certificated helicopters equipped with external load attachment provisions or devices or both.

Proposed Amendments to §§ 27.865(b)(3)(ii) and 29.865(b)(3)(ii)

Proposed §§ 27.865(b)(3)(ii) and 29.865(b)(3)(ii) would require protection of the quick-release subsystems against potential internal and external sources of electromagnetic interference (EMI) and lightning. The new requirements are

necessary to prevent inadvertent jettison of NHEC and HEC from sources such as stray electromagnetic signals, static electricity, and lightning strikes. Proposed field intensity levels are 200 volts per meter for applicable portions of QRS used for HEC and 20 volts per meter for applicable portions of QRS used for NHEC. The purpose of the requirements is for those applicable portions of the QRS to withstand these field intensity levels without inadvertent load release.

Proposed Amendments to §§ 27.865(b)(3)(iii) and 29.865(b)(3)(iii)

Proposed §§ 27.865(b)(3)(iii) and 29.865(b)(3)(iii) would require that the quick-release subsystems be protected against failures that could occur as a result of an electrical or mechanical malfunction of other rotorcraft components.

Proposed Amendments to §§ 27.865(c) and 29.865(c).

This proposal would redesignate existing §§ 27.865(c) and 29.865(c) as §§ 27.865(e) and 29.865(e), respectively. New §§ 27.865(c) and 29.865(c) are proposed to separately address the safety requirements for HEC carriage. The new requirements would ensure that the HEC certification requirements are clearly and properly identified.

Proposed Amendments §§ 27.865(c)(1) and 29.865(c)(1)

Proposed §§ 27.865(c)(1) and 29.865(c)(1) would require that the HEC load release primary and backup controls meet the requirements of §§ 27.865(b) and 29.865(b), respectively, and that both controls be designed to require dual

actuation (i.e., require two distinct actions) for load release. This is necessary to mitigate inadvertent HEC release.

Proposed Amendments to §§ 27.865(c)(2) and 29.865(c)(2)

Proposed §§ 27.865(c)(2) and 29.865(c)(2) would require that the applicant demonstrate that the PCDS is reliable in accordance with the HEC provisions of §§ 27.865(b)(3)(i) and 29.865(b)(3)(i), respectively; has the structural capability required under §§ 27.865(a) and 29.865(a), respectively; and has the essential personnel safety provisions (based on the design configuration of the PCDS) to minimize hazards to occupants carried external to the rotorcraft.

Proposed Amendments to §§ 27.865(c)(3) and 29.865(c)(3)

Proposed §§ 27.865(c)(3) and 29.865(c)(3) would require that all necessary placards and markings be provided and be properly located to facilitate their proper use and, for the PCDS, to clearly specify the ingress and egress instructions.

Proposed Amendments to §§ 27.865(c)(4) and 29.865(c)(4)

Proposed §§ 27.865(c)(4) and 29.865(c)(4) would require that an intercom system or other approved equipment be installed to ensure proper communication among crewmembers and occupants during an emergency. For simple rescue systems that do not have intercom systems mandated by operating regulations, voice signals or hand signals to PCDS occupants may be

acceptable. In more complex systems, it is intended that more sophisticated communication systems, such as intercoms, be provided.

Proposed Amendments to §§ 27.865(c)(5) and 29.865(c)(5)

Proposed §§ 27.865(c)(5) and 29.865(c)(5) would require that all flight limitations and procedures for HEC operations be identified and incorporated in the flight manual.

Proposed Amendment to § 29.865(c)(6)

To be compatible with part 133.45(e), proposed § 29.865(c)(6) would require, for HEC operations that require the use of Category A rotorcraft only (Class D RLC), that one-engine-inoperative hover performance capability information based on a dynamic engine failure (simulated engine failure in an actual test rotorcraft) be provided in the flight manual for the operating weights, altitudes, and temperatures for which external load approval is requested.

Proposed Amendments §§ 27.865(d) and 29.865(d).

Proposed new §§ 27.865(d) and 29.865(d) would require that critically configured jettisonable external loads (class and type) must be shown to be both transportable and releasable without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions. Compliance with the proposed requirements can be accomplished by using a combination of

analysis, ground tests, and flight tests. This is necessary to ensure that the extremities of the operating range are thoroughly explored without unnecessary risk and cost. The new provisions would mitigate HEC transport problems such as entanglements with the rotorcraft in flight and will provide a mandatory flight test validation of the QRS. Current §§ 27.865(d) and 29.865(d) would be revised and redesignated as §§ 27.865(f) and 29.865(f), respectively.

Proposed Amendments to §§ 27.865(e) and 29.865(e)

Current §§ 27.865(c) and 29.865(c) would be revised and redesignated as §§ 27.865(e) and 29.865(e), respectively. The proposals would amend these sections by adding a requirement to install a placard next to the external load attaching means that specifies any operational limitations in addition to the maximum authorized external load weight that can be attached.

Proposed Amendments to §§ 27.865(f) and 29.865(f)

Sections 27.865(d) and 29.865(d) would be revised and redesignated as §§ 27.865(f) and 29.865(f), respectively. These paragraphs would require that for NHEC, all critical structural elements such as those in the external load attachment and carrying system whose failure would result in a hazard to the rotorcraft (not just the cargo hook) have a fatigue analysis in accordance with §§ 27.571 and 29.571, as applicable. The proposals would also require that for

HEC, the entire QRS and PCDS and their attachments to the rotorcraft have a fatigue analysis in accordance with §§ 27.571 or 29.571, as applicable.

Regulatory Evaluation Summary

Changes to federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation). In conducting these analyses, which are summarized as follows (and available in the docket), the FAA has determined that this proposed rule would generate benefits exceeding its costs and is not "a significant regulatory action" as defined in Executive Order 12866 and the Department of Transportation's Regulatory Policies and Procedures. In addition, this proposed rule would not have a

significant impact on a substantial number of small entities, would not constitute a barrier to international trade, and would not result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually.

The FAA invites the public to provide comments (and related data) on the assumptions made in this evaluation. All comments received will be considered in the final regulatory evaluation.

Costs and Benefits

Costs

The FAA evaluated the proposed rule for the time frame extending from its expected implementation date through the operating lives of 75 rotorcraft that are projected to be produced during initial 15-year production runs and placed into part 133 service. Over the course of this evaluation period, incremental costs would total approximately $388,500 (1996 dollars), or $203,000 discounted to present value (using an interest rate of seven percent and letting "present" be the date of initial type certification application). Of the $388,500 total cost, $156,000 is attributable to incremental design, analysis, test, and other certification costs, $30,000 to incremental production costs (75 rotorcraft at $400 each), and $202,500 to incremental weight penalty fuel costs ($180 per year per rotorcraft over 15-year operating lives of 75 rotorcraft). On a per-rotorcraft basis,

costs would average approximately $5,200, or $2,700 discounted. These incremental costs would be offset to some extent by potential cost savings associated with the harmonization of these proposals with the JAA and eventual creation of identical JAA airworthiness standards, streamlining of certification approvals for part 133 operators, and some relaxed requirements for parts 27 and 29 manufacturers (see Benefits section).

Benefits

To estimate the safety benefits of the proposed rule, the FAA reviewed records of accidents involving part 133 operators that occurred between mid-1983 and mid-1994 that could have been prevented or the losses reduced if the proposed changes were in effect. During the 11-year period, there were 17 such accidents involving fatal and/or non-fatal injuries, or damage to equipment, or both. Eight of the accidents resulted in harm to persons (either inside or outside of the rotorcraft), totaling eight fatalities and two serious injuries. Fifteen of the 17 accidents involved either substantial damage (seven) or destruction of the rotorcraft (eight).

To provide a basis for comparing the safety benefits and costs of rulemaking actions, the FAA currently uses a minimum statistical value of $2.7 million for a fatality avoided and $518,000 for a serious injury avoided. Applying these standards to the casualty losses summarized above and making allowances for

the costs of rotorcraft damage, the total cost of the 17 accidents was approximately $27.2 million.

The FAA estimates that the proposed rule could prevent at least 50 percent of the type of accidents summarized above. Applying it retrospectively would yield dollar benefits of approximately $13.6 million (one-half of $27.2 million). Over the 11-year accident evaluation period, the part 133 fleet averaged approximately 300 active rotorcraft. Therefore, the benefits would average approximately $4,100 per year per rotorcraft ($13.6 million/11 years/300 operating part 133 rotorcraft per year). Applying this per-rotorcraft safety benefit to the cumulative number of complying rotorcraft results in total safety benefits of $4.6 million (or $1.3 million discounted to present value). On a per-rotorcraft basis, these benefits would average approximately $61,500, or $17,300 discounted.

In addition to improving safety, the proposed rule would provide some cost-relief in certain respects. New production rotorcraft would be delivered with standardized procedures for external load operations, and could save part 133 operators as much as $10,000 per certification. Further, changes to current regulations that relate to the primary and backup quick-release devices would reduce production costs for parts 27 and 29 rotorcraft manufacturers. The changes would also increase harmonization and commonality between U.S. and

European airworthiness standards. Harmonization would eliminate unnecessary differences in airworthiness requirements, thus reducing manufacturers' certification costs.

Comparison of Costs and Benefits

The proposed rule would generate benefits in the form of increased safety and cost relief (see preceding paragraph - the potential cost relief has not been included in the cost/benefit calculation). On a per-rotorcraft basis, the life-cycle safety benefits would average approximately $17,300 (discounted) and the costs would average approximately $2,700 (discounted), yielding a benefit-to-cost ratio of 6.4 to 1. On this basis alone, the proposed rule is cost-beneficial; additional quantified efficiency and harmonization benefits would increase this ratio.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed or final rule would have a "significant economic impact," either detrimental or beneficial, on a "substantial number of small entities." The Small Business Administration has established standards for complying with RFA review requirements in Federal rulemaking actions; the standards specify small entity size by Standard Industrial Classification (SIC).

The entities that would be affected by the proposed rule consist of rotorcraft manufacturers and external load operators. Manufacturers would incur additional development, certification, and production costs. In addition to indirectly incurring all or part of these costs in the form of higher rotorcraft acquisition costs, operators would incur increased fuel costs resulting from weight penalties. Although the certification costs (non-recurring) would be either fully absorbed by the manufacturer(s), passed on in-total to operator(s) (purchasers), or more likely, absorbed in some proportion by both, the FAA in this analysis adopts a conservative approach and allocates total certification costs to each category in assessing significant economic impact. On the other hand, incremental per-unit production costs are assumed to be fully passed on to purchasers (operators).

For manufacturers, a small entity is one with 1,500 or fewer employees. A few rotorcraft manufacturers have 1,500 or fewer employees and therefore qualify as small entities. However, the annualized certification costs of approximately $3,800 per manufacturer is not considered significant within the meaning of the RFA. Consequently, the FAA determines that the proposed rule would not have a "significant economic impact on a substantial number of small entities" (manufacturers).

There are numerous external load operators. The FAA has not determined how many of these are small operators and if a substantial number would be impacted by the proposal. However, the maximum annualized cost per small operator, excluding potential offsetting cost-savings, would most likely not be greater than $3,140. The FAA does not consider this significant within the meaning of the RFA. Therefore, the FAA determines that the proposed rule would not have a "significant economic impact on a substantial number of small entities" (rotorcraft operators).

International Trade Impact Assessment

Consistent with the Administration's belief in the general superiority, desirability, and efficacy of free trade, it is the policy of the Administrator to remove or diminish, to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and those affecting the import of foreign goods and services into the United States.

In accordance with that policy, the FAA is committed to develop as much as possible its aviation standards and practices in harmony with its trading partners. Significant cost savings can result from this, both to United States' companies doing business in foreign markets, and foreign companies doing business in the United States.

This proposed rule is a direct action to respond to this policy by increasing the harmonization of the U.S. Federal Aviation Regulations with the European Joint Aviation Requirements. The result would be a positive step toward removing impediments to international trade.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Pub. L. 104-4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed "significant intergovernmental mandate." A "significant intergovernmental mandate" under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small

governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

The FAA determines that this proposed rule does not contain a significant intergovernmental or private sector mandate as defined by the Act.

List of Subjects

14 CFR Part 27

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

14 CFR Part 29

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

The Proposed Amendments

In consideration of the foregoing, the Federal Aviation Administration proposes to amend parts 27 and 29 of Title 14, Code of Federal Regulations (14 CFR parts 27 and 29) as follows:

PART 27 - AIRWORTHINESS STANDARDS: NORMAL CATEGORY ROTORCRAFT

1. The authority citation for part 27 continues to read as follows:

Authority: 49 USC 106(g), 40113, 44701-44702, 44704.

2. Section 27.25 is amended by revising paragraph (c) to read as follows:

* * * * *

(c) *Total weight with jettisonable external load.* A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established under paragraph (a) of this section may be established for any rotorcraft-load combination if--

(1) The rotorcraft-load combination does not include human external cargo,

(2) Structural component approval for external load operations under either § 27.865, or under equivalent operational standards is obtained,

(3) The portion of the total weight that is greater than the maximum weight established under paragraph (a) of this section is made up only of the weight of all or part of the jettisonable external load,

(4) Structural components of the rotorcraft are shown to comply with the applicable structural requirements of this part under the increased loads and stresses caused by the weight increase over that established under paragraph (a) of this section, and

(5) Operation of the rotorcraft at a total weight greater than the maximum certificated weight established under paragraph (a) of this section is limited by appropriate operating limitations under § 27.865 (a) and (d) of this part.

3. The Undesignated Center Heading before § 27.865 is revised from "EXTERNAL LOAD ATTACHING MEANS" to "EXTERNAL LOADS."

4. Section 27.865 is amended by revising the section title and paragraphs (a) and (b), by redesignating and revising paragraph (c) as (e), by redesignating and revising paragraph (d) as (f), and by adding new paragraphs (c) and (d) to read as follows:

§ 27.865 External loads.

(a) It must be shown by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for nonhuman external cargo applications can withstand a limit static load equal to 2.5, or some lower load factor approved under §§ 27.337 through 27.341, multiplied by the maximum external load for which authorization is requested. It must be shown by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under §§ 27.337 through 27.341, multiplied by the maximum external load for which authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, must be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load must

also be applied in any direction making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if--

(1) * * *

(2) * * *

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, must include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system must consist of a primary quick release subsystem and a backup quick release subsystem that are isolated from one another. The quick-release system, and the means by which it is controlled, must comply with the following:

(1) A control for the primary quick release subsystem must be installed either on one of the pilot's primary controls or in an equivalently accessible location and must be designed and located so that it may be operated by either the pilot or a crewmember without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(2) A control for the backup quick release subsystem, readily accessible to either the pilot or another crewmember, must be provided.

(3) Both the primary and backup quick release subsystems must--

(i) Be reliable, durable, and function properly with all external loads up to and including the maximum external load for which authorization is requested.

(ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release.

(A) The minimum level of protection required for jettisonable rotorcraft-load combinations used for nonhuman external cargo is a radio frequency field strength of 20 volts per meter.

(B) The minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per meter.

(iii) Be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft must--

(1) For jettisonable external loads, have a quick-release system that meets the requirements of paragraph (b) and that--

(i) Provides a dual actuation device for the primary quick release subsystem, and

(ii) Provides a separate dual actuation device for the backup quick release subsystem.

(2) Have a reliable, approved personnel carrying device system that has the structural capability and personnel safety features essential for external occupant safety,

(3) Have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, the ingress and egress instructions.

(4) Have equipment to allow direct intercommunication among required crewmembers and external occupants, and

(5) Have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations.

(d) The critically configured jettisonable external loads must be shown by a combination of analysis, ground tests, and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under § 27.25 and this section.

(f) The fatigue evaluation of § 27.571 of this part does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of § 27.571 of this part applies to the entire quick release and personnel carrying device structural systems and their attachments.

PART 29 - AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

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

Authority: 49 USC 106(g), 40113, 44701-44702, 44704.

6. Section 29.25(c) is revised to read as follows:

* * * * *

(c) *Total weight with jettisonable external load.* A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established under paragraph (a) of this section may be established for any rotorcraft-load combination if--

(1) The rotorcraft-load combination does not include human external cargo,

(2) Structural component approval for external load operations under either § 29.865 or under equivalent operational standards is obtained,

(3) The portion of the total weight that is greater than the maximum weight established under paragraph (a) of this section is made up only of the weight of all or part of the jettisonable external load,

(4) Structural components of the rotorcraft are shown to comply with the applicable structural requirements of this part under the increased loads and stresses caused by the weight increase over that established under paragraph (a) of this section, and

(5) Operation of the rotorcraft at a total weight greater than the maximum certificated weight established under paragraph (a) of this section is limited by appropriate operating limitations under § 29.865 (a) and (d) of this part.

7. The Undesignated Center Heading before § 29.865 is revised from "EXTERNAL LOAD ATTACHING MEANS" to "EXTERNAL LOADS"

8. Section 29.865 is amended by revising the section title and paragraphs (a) and (b), by redesignating and revising (c) as (e), by redesignating and revising paragraph (d) as (f), and by adding new paragraphs (c) and (d) to read as follows:

§ 29.865 External loads.

(a) It must be shown by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for nonhuman external cargo applications can withstand a limit static load equal to 2.5, or some

lower load factor approved under §§ 29.337 through 29.341, multiplied by the maximum external load for which authorization is requested. It must be shown by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under §§ 29.337 through 29.341, multiplied by the maximum external load for which authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, must be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load must also be applied in any direction making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if--

(1) * * *

(2) * * *

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, must include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system must consist of a primary quick release subsystem and a backup quick release subsystem that

are isolated from one another. The quick release system, and the means by which it is controlled, must comply with the following:

(1) A control for the primary quick release subsystem must be installed either on one of the pilot's primary controls or in an equivalently accessible location and must be designed and located so that it may be operated by either the pilot or a crewmember without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(2) A control for the backup quick release subsystem, readily accessible to either the pilot or another crewmember, must be provided.

(3) Both the primary and backup quick release subsystems must--

(i) Be reliable, durable, and function properly with all external loads up to and including the maximum external load for which authorization is requested.

(ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release.

(A) The minimum level of protection required for jettisonable rotorcraft-load combinations used for nonhuman external cargo is a radio frequency field strength of 20 volts per meter.

(B) The minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per meter.

(iii) Be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft must--

(1) For jettisonable external loads, have a quick-release system that meets the requirements of paragraph (b) and that--

(i) Provides a dual actuation device for the primary quick release subsystem, and

(ii) Provides a separate dual actuation device for the backup quick release subsystem.

(2) Have a reliable, approved personnel carrying device system that has the structural capability and personnel safety features essential for external occupant safety.

(3) Have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, ingress and egress instructions,

(4) Have equipment to allow direct intercommunication among required crewmembers and external occupants,

(5) Have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations, and

(6) For human external cargo applications requiring use of Category A rotorcraft, have one-engine-inoperative hover performance data and procedures in the flight manual for the weights, altitudes, and temperatures for which external load approval is requested.

(d) The critically configured jettisonable external loads must be shown by a combination of analysis, ground tests, and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under § 29.25 and this section.

(f) The fatigue evaluation of § 29.571 of this part does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of § 29.571 of this part applies to the entire quick release and personnel carrying device structural systems and their attachments.

Issued in Washington, DC, on

EXECUTIVE SUMMARY

TITLE: Rotorcraft Load Combination Safety Requirements Proposals

WHO WILL BE AFFECTED: Rotorcraft manufacturers and occupants of normal and transport category rotorcraft.

SUMMARY: This notice proposes the amendment of the airworthiness standards for rotorcraft-load combinations (RLC). This proposal would revise the safety requirements for the RLC's to address advances in technology and to provide an increased level of safety in the carriage of humans. The proposal would provide identical, improved external load standards for rotorcraft certificated under parts 27 and 29 and would provide RLC Class D certification standards under part 29. In addition to improving the safety standards for rotorcraft-external load certification, these proposed amendments would provide harmonized international standards.

BACKGROUND: Following an announcement in the Federal Register (56 FR 63546, December 4, 1991), Aviation Rulemaking Advisory Committee (ARAC) chartered the External Load Working Group to make recommendations concerning whether new or revised airworthiness standards are appropriate for Class D rotorcraft external loads.

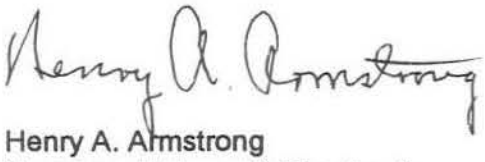
The FAA has evaluated the working group's recommendations to ARAC and concluded that parts 27 and 29 should be revised to ensure an increased margin of safety in rotorcraft external load operations. These revisions are necessary to establish modern safety standards that accommodate current operational RLC applications and procedures and provide separate levels of safety for nonhuman external cargo (NHEC) and human external cargo (HEC). These changes to parts 27 and 29 include the addition of (1) increased load factors for HEC; (2) increased quick-release system safety standards for both NHEC and HEC; (3) new personnel-carrying device systems (PCDS) standards for HEC; (4) new flight-handling characteristic standards for both NHEC and HEC; (5) increased fatigue substantiation standards for both NHEC and HEC; and (6) to part 29 only, the RLC Class D standard. These improvements to the safety standards should prevent many accidents and incidents.

SIGNIFICANT ISSUES: None.

COSTS AND BENEFITS: The proposed rule would generate benefits in the form of increased safety and cost relief. On a per-rotorcraft basis, the life-cycle safety benefits would average approximately $17,300 (discounted) and the costs would average approximately $2,700 (discounted), yielding a benefit-to-cost ratio of 6.4 to 1. On this basis alone, the proposed rule is cost-beneficial; additional quantified efficiency and harmonization benefits would increase this ratio.

ENERGY IMPACT: The energy impact of the notice of proposed rulemaking has been assessed in accordance with the Energy Policy and Conservation Act (EPCA), P.L. 94-163, and Interim Agency Guidelines. It has been determined that the notice of proposed rulemaking is not a major regulatory action under the provisions of the EPCA.

ENVIRONMENTAL IMPACT: The environmental impact of the notice of proposed rulemaking has been assessed in accordance with FAA Order 1050.1D, and it has been determined that the notice of proposed rulemaking is not a major Federal action significantly affecting the environment.



Henry A. Armstrong
Manager, Rotorcraft Directorate,
Aircraft Certification Service

373. § 29.865 (through Amendment 29-33) EXTERNAL LOADS

a. Background. In the United States (U.S.), the external load attaching means standards for transport and normal category rotorcraft were originally contained in Subpart D, "Airworthiness Requirements of FAR Part 133, Rotorcraft External-Load Operations." Amendment 29-12, issued in 1977, added a new § 29.865, which moved these standards from Part 133 to Part 29. An identical transfer occurred in 1977 for Part 27. Amendment 29-26, issued in 1990, clarified the intent of Amendment 29-12 but did not change it substantively. Transport Categories A and B and Normal Category rotorcraft were initially used under Part 133 operations, and after Amendment 133-6, restricted category rotorcraft were also included under Part 133 operations. The carriage of persons external to the rotorcraft for hire first came about when a Part 29 operator, exempt from Part 133, transferred harbor pilots to and from ships by a hoist and sling. The exemption was granted to study the feasibility of passenger transfer outside of the cabin. Grant of the exemption was based, in part, on similar, prior operations that had been conducted in Europe and Africa, for hire, with helicopters certified by the appropriate authorities and, in part, on similar military and public helicopter operations, not for hire, in the U.S. Subsequently, Amendment 133-9, adopted in January 1987, established a new Class D rotorcraft load combination (RLC) for transporting loads other than Class A, B, or C that are specifically approved by the administrator external to the rotorcraft. Amendment 133-9 also provided for the limitations and conditions for transport of external loads other than Class A, B, or C and the necessary, associated safety requirements. Part 29 has recently been changed to reflect RLC Class D requirements. Also, the scope and thus the title of the standard have changed from "External load attaching means" to "External loads" to reflect the more comprehensive approach for external loads required to ensure the proper level-of-safety.

In other Nations the operations standards have developed differently and more diversely and do not necessarily use the RLC Class A, B, C and D definitions of § 1.1 in the same way as FAA operations standards do. Thus the International commonality of this advisory material (like § 29.865) is based on whether or not an external load is jettisonable or non-jettisonable and whether or not the load is HEC or NHEC.

Whenever possible, the more generic, internationally harmonized terminology (i.e., jettisonable or non-jettisonable and HEC or NHEC) is used in this material. However, references to U.S. operational terms are made in parentheses where deemed necessary and tabulated to ensure clarity of purpose and proper, consistent approvals to U.S. operations standards.

b. Explanation.

This advisory material contains guidance for certification of helicopter external load attaching means and load carrying systems to be used in conjunction with operating rules such as Part 133, "Rotorcraft External Load Operations." Subpart D of Part 133 contains supplemental U.S. airworthiness requirements. FAR Part 1 defines four RLC classes that are approvable under the U.S. Part 133 operating rules and that are eligible for certification under § 29.865. The four U.S. RLC classes are summarized in Table 373-1 and discussed in paragraph d. Under U.S. operating rules RLC Classes A, B, and C are eligible, under specific restrictions, for both human external cargo (HEC) and nonhuman external cargo (NHEC) operations. However, under U.S. operating rules, RLC Class D only is eligible for transporting HEC for compensation (see Table 373-1). For further information, AC 133-1A, "Rotorcraft External-Load Operations in Accordance with FAR Part 133," October 16, 1979, may be reviewed. Also, paragraph 43 of this AC (reference § 29.25) concerns, in part, jettisonable external cargo.

Includes JAA Comments of 8/29/94

FAR 29.865 provides a minimum level of safety for rotorcraft designs to be used with operating rules such as Part 133. Certain aspects of operations such as microwave tower and high-line wire work may also be regulated separately by other Federal agencies such as DOE, EPA, and OSHA or by other international entities. For applications that could come under multiple agency regulation (or regulation by other entities), special certification emphasis will be required by both the applicant and the certifying authority to ensure all relevant safety requirements are identified and met. Potential additional requirements, where thought to exist, are noted herein.

The methods of this AC are intended to apply only to either new designs or to major modifications that occur after the effective date of Amendment 29-XX (i.e., "ADD DATE"). Thus it is not intended that these requirements be imposed retroactively. However, after the effective date of Amendment 29-xx, all applications to certify new rotorcraft systems for NHEC or HEC operations would be required to comply with the equipment standards, as well as, the operational requirements in effect at that time.

c. Definitions.

(1) Applicable cargo type. The cargo type (i.e., NHEC, HEC, or both) that each RLC Class is eligible to use by regulation (Table 373-1 contains explicit definitions for U.S. Part 133 Operations).

(2) Backup Quick-Release Subsystem (BQRS). The secondary or "second choice" subsystem used to perform a normal or emergency jettison of external cargo.

(3) Cargo. The part of any Rotorcraft-Load Combination that is removable, changeable, and is attached to the rotorcraft by an approved means.

(4) Cargo hook. A hook that can be rated for both HEC and NHEC. It is typically used by being fixed directly to a designated hardpoint on the rotorcraft.

(5) Critical configuration. In cases where NHEC or HEC can have more than one shape, center-of-gravity, center-of-lift, and/or be carried at more than one distance in flight from the rotorcraft attachment, a critical configuration for certification purposes may or may not be determinable. If such a critical configuration can be shown to exist, then it may be examined for approval as a "worst case" (in lieu of examining the entire range of configurations that exist) to satisfy a particular certification criterion or several criteria, as appropriate.

(6) Dual actuation device (DAD). This is a sequential control that requires two distinct actions in series for actuation. One example is a covered switch that would require cover removal (or flip-up) followed by a switch activation for load release to occur. Another example is removal of a lock pin followed by a "then free" switch or lever activation for load release to occur. Under this definition, a load release switch protected by an uncovered switch guard is not acceptable.

(7) Emergency jettison (or complete load release). The intentional, instantaneous release of NHEC or HEC in a preset sequence by the QRS that is normally performed to achieve safer operation in an emergency (i.e., nonoptimum situation).

(8) External fixture. A structure external to and in addition to the basic airframe that does not have true jettison capability and has no significant payload capability in addition to its own weight. An example is an agricultural spray boom. These configurations are not "External Loads" certifiable under § 29.865.

(9) Fixed line flyaway. This is a helicopter extrication technique in which a person or persons in a PCDS are connected to a rope or cable attached to a helicopter. The aircraft lifts off with the HEC carried below it. The exact length of the line depends on the specific needs of the operation.

(10) Human external cargo (HEC). A person(s) that at some point in the operation is carried external to the rotorcraft. (Table 373-1 contains explicit definitions for U.S. Part 133 Operations).

(11) Nonhuman external cargo (NHEC). Any external cargo operation that does not at any time involve a person(s) carried external to the rotorcraft (Table 373-1 contains explicit definitions for U.S. Part 133 Operations).

(12) Normal jettison (or selective load release). The intentional release, normally at optimum jettison conditions, of an NHEC.

(13) Personnel carrying device system (PCDS). The entire attached or suspended system used to carry HEC. This is any HEC carrying configuration such as a suspended (e.g., winch/hoist, cable, harness) HEC system or an attached (e.g., a rigid basket or cage attached to skids) HEC system.

(14) Primary Quick-Release Subsystem (PQRS). The primary or "first choice" subsystem used to perform a normal or emergency jettison of external cargo.

(15) Quick-release system (QRS). The entire release system for jettisonable external cargo, (i.e., the sum total of both the primary and backup quick-release subsystems). The QRS consists of all components including the controls, the release devices, and everything in between.

(16) Rescue hook (or hook). A hook that can be rated for both HEC and NHEC. It is typically used in conjunction with a winch/hoist or equivalent system.

(17) Rotorcraft: A vehicle that depends principally for its support in flight on the lift generated by one or more rotors. For the purposes of this Advisory Material, the word "rotorcraft" is intended to include all the crew and occupants.

(18) Spider: A spider is a system of attaching a lowering cable or rope or a harness to an HEC (or NHEC) RLC to eliminate unwanted flight dynamics during operations. A spider usually has four or more legs (or load paths) that connect to various points of a PCDS to equalize loading and prevent spinning, twisting, or other undesirable flight dynamics.

(19) True jettison capability. The ability to safely release an external load using an approved QRS in 30 seconds or less.

NOTE: In all cases, a PQRS should release the external load in less than 5 seconds. Many PQRS's will release the external load in milliseconds, once the activation device is triggered. However a manual BQRS such as a set of cable cutters could take as much as 30 seconds to release the external load. The 30 seconds would be measured starting from the time the release command is given and ending when the external load is cut loose.

(20) True payload capability. The ability of an external device or tank to carry a significant payload in addition to its own weight. If little or no payload can be carried, the external device or tank is an external fixture (see definition).

(21) Type inspection authorization (TIA). This is FAA Form 8110-1. It is used only for the purpose of authorizing official ground inspections and flight

tests necessary to fulfill the requirements for type certification or supplemental type certification. Order 8110.4, Chapter 2, Section 1, Paragraph 16, states the criteria for TIA issuance.

(22) Winch/hoist. A winch is defined as a device that can employ a cable and drum or other means to exert a horizontal (i.e., x-rotorcraft axis) pull. A hoist is a similar device that exerts a vertical pull (i.e., a pull that does not typically exceed a 30 degree cone measured around the z-rotorcraft axis). The majority of "pull" devices used on rotorcraft are hoists. However, since a winch can be used to perform a hoist function by use of a 90 degree cable direction change device (such as a pulley or pulley system), a winch system is approvable. Thus the terms "winch/hoist" and "winch/hoist system" are used throughout this AC.

(23) Winch/hoist demonstration cycle (or "one cycle"). This is the complete extension and retraction of at least 95 percent of the actual cable length, or 100 percent of the cable length capable of being used in service (i.e., that would activate any extension/retraction limiting devices), whichever is greater.

(24) Winch/hoist load-speed combinations. Some winch/hoist designs are such that the extension/retraction speed slows down as the load increases or near the end of a cable extension. Other winch/hoist designs maintain a constant speed as the load is varied. In the latter design, the load-speed combination simply means the variation in load at the constant design speed of the winch/hoist.

d. Procedures.

Because of the technical detail contained in subparagraph (d); the following index is provided to assist in locating specific compliance procedures.

Includes JAA Comments of 8/29/94

(1) General Compliance Procedures for § 29.865: For compliance with § 29.865, the applicant should clearly identify the Parts 1 and 133 RLC's (i.e., the type of operations) that are being applied for and all applicable cargo types (i.e., NHEC or HEC) that will be used (See Table 373-1 following, for specific U.S. definitions). The structural loads and operating envelopes for each RLC class and applicable cargo type should be determined and used to formulate the flight manual supplement and basic loads report. The applicant should show by analysis, test, or both, that the rotorcraft structure, the external load attachment means, and (for HEC operations the PCDS meet the specific requirements of §§ 29.865, 133.41, 133.43, 133.45, and the other relevant requirements of Part 29 for the proposed operating envelope.

In general, for compliance with § 29.865, the methods described by the following, procedural paragraphs are acceptable.

NOTE: It is possible, if approvable, to carry both HEC and NHEC externally, simultaneously as two separate external loads. However, in no case is it intended that the approved Maximum Internal Gross Weight be exceeded for any approved HEC configuration (or combined NHEC/HEC configuration) in normal operations.

(2) General Static Structural Substantiation Procedures for § 29.865(a): The following static structural substantiation methods are required to be used (paragraph d(21) describes the fatigue substantiation methodology)

(i) Static structural substantiation: The following methods of static structural substantiation should be employed.

(A) NHEC applications. In most cases a standard static analysis alone is acceptable to show compliance.

(B) HEC applications. If a safety factor of 3.0 or more on the yield strength of the weakest component in the QRS, PCDS, and attachment(s) load path is used, only an analysis is required for certification. Otherwise, both an analysis and a full-scale ultimate load test of relevant parts of the QRS, PCDS, and its attachments that form the HEC load path(s) should be submitted.

(ii) NHEC applications. For NHEC applications, use of 2.5 g vertical limit load factor (N_{ZW}) at the maximum substantiable cargo load (which is typical for heavy gross weight NHEC hauling configurations) is required. This 2.5 g limit load factor is based on an engineering evaluation and a rationalization of § 29.337 for high gross weight applications.

(iii) HEC applications. For HEC applications, which typically involve lower gross weight configurations, a higher limit load factor is required to ensure that limit load is never exceeded in service. The higher load factor for HEC applications should be the analytically derived maximum vertical limit load factor for the restricted operating envelope being applied for or, as a conservative option, a vertical limit load factor of 3.5 g's (reference § 29.337). Unless a more rational proposal is received, for HEC applications where maximum operating gross weight for the external load is between design maximum weight and design minimum weight, linear interpolation can be used between $N_{ZW\ MIN}$ and $N_{ZW\ MAX}$ versus gross weight to determine the design limit load factor. In no case may the vertical limit load factor be less than 2.5 g's for any RLC application for HEC. For example, an HEC external load-carrying attachment or PCDS that is certified to a limit vertical load factor of 2.5 g's and is installed in a minimum gross weight configuration rotorcraft capable of generating a vertical limit load factor of 3.2 g's could experience ((3.2/[2.5 x 1.5]) x 100) = 85 percent of ultimate load (i.e., 128 percent of limit load) under worst case conditions with new external hardware. However, if factors such as wear and corrosion have affected the structural integrity of the external load carrying hardware, the limit and ultimate load capability may decrease significantly and the current design standard could be exceeded. Certification policy is not to exceed limit load in service. Therefore, to meet the requirement of 29.865(a), the external load carrying hardware would need to be designed to a higher design standard (i.e., to withstand a limit load factor of 3.2g's.).

Includes JAA Comments of 8/29/94

TABLE 373-1
U.S. OPERATIONAL (PART 133) ROTORCRAFT-LOAD COMBINATION VERSUS APPLICABLE CARGO TYPE DATA AND DEFINITION SUMMARY

ROTORCRAFT-LOAD COMBINATION CLASS, CARGO TYPE	REQUIREMENT FOR TRANSPORT CATEGORY "A" RATING AND OEI HOVER CAPABILITY
A, NHEC	NONE
A, HEC (SEE NOTE 2)	NONE
B, NHEC	NONE
B, HEC (SEE NOTE 2)	NONE
C, NHEC	NONE
C, HEC (SEE NOTE 2)	NONE
D, NHEC	NOT APPLICABLE (SEE NOTE 4)
D, HEC (SEE NOTE 1)	YES (SEE NOTE 3)

NOTES:

1. A person(s) (passenger OTHER than a crewmember and/or OTHER than a person who is essential to the external-load operation), when carried as an external load, can only be carried as a Class D RLC. These persons are being carried (transported).

2. A person WHO IS a crewmember or a person WHO IS essential and directly connected with the external-load operation is not being carried (transported) as a passenger. They are, instead, part of the operation. These persons are considered as RLC Class A, B, or C HEC as appropriate to the operation.

3. The rotorcraft are required to meet the Transport Category A engine isolation requirements of Part 29 and have OEI/OGE hover performance capability, over the operating and weight envelopes applied for, to be eligible for certification to the Class D RLC.

4. NHEC Class D operations are not applicable. An alternate NHEC operational configuration, using the same rotorcraft, would become either a Class A, B, or C NHEC operation.

5. A Class D RLC operation may be conducted with an external cargo design having a physical configuration that meets the definitions of § 1.1 for RLC Class A, B, or C.

6. OEI power settings should not be used for certification credit for normal operations. However, they are available for the OEI emergency scenarios for which approval has been granted whether or not a NHEC or HEC is involved. For determination of the maximum rotorcraft gross weight approved for Class D operations (i.e., HEC operations performed with a multiengine rotorcraft capable of OEI HOGE, it is intended that use of the maximum OEI Power approved for the rotorcraft engine and drive system be allowed after failure of the critical engine (when applied in conjunction with an approved Class D operating procedure). Thus, it would be acceptable to base the required OEI/OGE hover performance capability for a Class D operation on a 30-second OEI power rating if the operator can demonstrate that the HEC can be safely transitioned to a flight condition where the HEC can be retrieved inside the rotorcraft for an execution of a normal OEI landing. If the specific operation for which the Class operation approval is requested does not provide for safe disposition of the HEC when using a time limited OEI rating, the Class D operation gross weight should be limited to a gross weight where OEI/OGE hover capability can be demonstrated for a continuous time period.

7. Table 373-1 is based on analogous information contained in Chapter 96 of FAA Order 8700.1. In case of conflicting information, Order 8700.1 takes precedence.

d (2) continued

(iv) Critical basic load determination. For all § 29.865(a) applications, obtain the gross weight range limits, obtain the corresponding limit load factors (N_{zw}), and statically substantiate the system, in accordance with the applied for external cargo application(s) [Reference d(1)], for the critical load(s). This determines the critical basic loads and associated operating envelope for the RLC's and applicable cargo types applied for.

(v) Critical Structural Case. For § 29.865(a) applications involving more than one RLC class and/or cargo type, structural substantiation is required only for the most critical case (Reference d(1)) if accurately determinable from analysis.

(vi) Placards and markings. For all § 29.865(a) applications, appropriate placards, markings, and flight manual restrictions should be provided for items such as operating procedures, load capacities, and operational restrictions for all external load systems and devices (See also, d(13)(iii)(B)). Each placard, marking, and flight manual supplement should be checked during TIA flight testing (See also, d(20)).

(vii) Vertical Limit and Ultimate Load Factors. For all § 29.865(a) applications, the basic vertical limit load factor (N_{zw}) from d(2) is converted to ultimate load by multiplying the maximum applied load [i.e., the sum of the carrying device load, its supporting external structure load, and the maximum cargo load] by 1.5. (For restricted category approvals, see guidance in Paragraph 785.) This ultimate load is used to substantiate all existing structure affected by and all added structure associated with the load carrying device, its attachments, and its cargo. Casting factors, fitting factors, and/or other dynamic load factors are to be applied where appropriate. For all HEC applications, the minimum weight of each occupant carried externally should be assumed, for analysis or test purposes, to be that of the 95 percentile 202-pound man (reference MIL-STD-1472, "Human Engineering Design Criteria for Military Systems, Equipment, and Facilities").

NOTE: If the HEC is engaged in special work tasks that would typically employ devices of significant added weight (such as heavy backpacks or fire extinguishers), the weight of these devices should be added to that of the 95 percentile 202-pound man and used in the structural analysis.

(viii) Winch/hoist system limit load. For all § 29.865(a) applications that employ winch/hoist systems to raise or lower either an HEC or NHEC from a hover, or other phase of flight, the system limit load is required to be properly determined based on the characteristics of the winch/hoist system and its installation such as mechanical advantage, static strength of the winch/hoist, static strength of its installation, allowable cable length, and the payload for any operating scenario being applied for. One acceptable method of determining the winch/hoist system limit load for any RLC and any applicable cargo type is by the following procedure:

NOTE: In cases where either winch/hoist cables or long-line cables are utilized, a new structural system is established. Certain characteristics of this system should be examined during certification to ensure that either no hazardous failure modes exist or that they are acceptably minimized. For example, the cable or long line may (in conjunction with the rotorcraft) exhibit an unacceptable natural frequency that could be excited by sources internal to the overall structural system (i.e., the rotorcraft) or by sources external to the system. Another example is the loading effect of the cable or long line acting as a spring between the rotorcraft and the suspended external load or ground, respectively, either during flight or (when in ground contact) at the time of load release. These conditions should be

d(2) continued)

reviewed and, if potentially hazardous, minimized by controlling relevant overall structural system parameters such as cable length.

(A) Determine the basic loads that fail and unspool the winch/hoist or its installation, respectively.

NOTE: This determination should be based primarily on static strength; however, any dynamic load magnification factors that are significant should be accounted for.

(B) Select the lower of the two values from (i) as the ultimate load of the winch/hoist system installation.

(C) Divide the selected ultimate load by 1.5 to determine the true structural limit load of the system.

(D) Determine the manufacturer's approved (or applicants applied for) "limit design safety factor." Divide this factor into the true structural limit load (from (c) above) to determine the winch/hoist system's working (or placarded) limit load. As a minimum, this factor should equal or exceed the value of all the factors defined under d(2)(vii) when multiplied together.

NOTE: Most winch/hoist manufacturers either use a "Limit design safety factor" of 4 to 5 on ultimate to determine their placarded limit load [i.e., allowable LL = UL/(4 to 5)]; or they use a safety factor of approximately 3 on yield to determine their placarded limit load [i.e., allowable LL = true LL/3.0]. In some cases, the load is swung through a cone of a 30 degree half apex angle. Typical structural design criteria is for the winch/hoist to remain in one piece and still function after experiencing true limit load, and to remain in one piece, but not necessarily function, after experiencing true ultimate load. These relatively large structural safety factors are used to conservatively account for phenomena such as casting factors in flight dynamic loading conditions, and wear and tear between phased inspections.

(E) Compare the system's derived limit load to the applied for one "g" payload multiplied by the maximum downward vertical load factor (N_{ZWMAX}) from paragraph d(2) to determine the critical payload's limit value.

(F) If the critical limit payload is equal to or less than the system's derived limit load, the installation is structurally approvable as presented.

NOTE: For HEC applications, the critical limit payload should be equal to or more than the combined weight of the PCDS and its maximum number of passengers (See also d(2)(vii), for passenger weight values).

(G) If the critical limit payload exceeds the system's derived limit load, then one of the following options should be considered:

(1) Disapproval.

(2) Application for exemption.

(3) Reduction of the applied for critical limit payload to less than or equal to the system's derived limit load.

d(2) continued

(4) Redesign of the winch/hoist system (and installation) to increase its derived limit load to equal to or greater than the critical payload.

(5) A combination of options *(3)* and *(4)*.

(6) Approvable operating restrictions to reduce N_{ZWMAX} and the corresponding critical limit payload to less than or equal to the system's derived limit load.

NOTE: Additional combinations of external load and operating restrictions may be subsequently approved under operational requirements as long as the FAR 29 structural limits of the basic certification are not exceeded, (i.e., equivalent safety is maintained).

(3) Functional Reliability and Durability Compliance Procedures for Winch/Hoist Systems under § 29.865(b)(3)(i): It is recommended that winch/hoist systems and their installations in the rotorcraft should be designed, certified, and demonstrated as follows.

(i) General. Winch/hoist systems should be approved to acceptable aircraft industry standards. These standards and any related manufacturer's certificates of production/qualification, thereto, should be presented by the applicant as part of the approval package. Two typical winch/hoist approval scenarios exist. They are:

(A) For established, previously approved winch/hoist unit designs that are to be placed in a new rotorcraft installation, certification credit (to Amendment TBD) for the unit itself can be given based on a successful unit design review (or a manufacturer's statement-of-certification accompanied by an FAA Form 8110-3 with appropriate DER approvals) that shows proper previous approval and that shows no new design changes have been made that adversely affect the reliability or function of the unit (i.e., an update of the FMEA). If so approved, then only the winch/hoist installation need be approved during certification.

(B) For new winch/hoist unit designs, the unit should be either certified to a standard aircraft industry specification that has been previously and successfully used to certify winch/hoist units, or an equivalent specification should be developed and met during the certification process.

NOTE: Background information. There are no generic industry, FAA, or military specifications currently available to apply to winch/hoist units. Thus, the detail specifications for winch/hoist unit certifications are typically generated as follows: 1) For military applications, the military dictates the basic winch/hoist unit specifications in the prime aircraft development specification. The airframe manufacturer then typically either writes or has a winch/hoist vendor write a detailed unit certification specification that includes all necessary, detailed certification criteria; 2) For commercial applications (that install the winch/hoist unit under either a new or amended type certificate or a supplemental type certificate), the airframe manufacturer typically either writes a detailed winch/hoist unit specification or has a vendor (usually the winch/hoist unit manufacturer) write the detailed certification specifications and procedures (based on the unit manufacturer's experience and the customer needs during the installation process). For either method, the FAA approves and adds the specification to the type data file during the installation approval process.

d(3) continued

(ii) NHEC applications. The winch/hoist/rescue hook system should be reliable for the phases of flight in which it is operable, unstowed, partially unstowed and/or in which NHEC is carried. The primary electrical and/or mechanical failure modes that should be identified and minimized are unintended load release by any means, and loss of continued safe flight and landing capabilities due to a winch/hoist/rescue hook system failure. However, any other winch/hoist/rescue hook system failure that could lead to a catastrophic failure mode for the rotorcraft should also be minimized. Loss of winch/hoist operational control should also be considered. The reliability of the system should be demonstrated by completion and approval of the following:

NOTE: It is assumed that only 1 winch/hoist cycle will typically occur per flight. This rationale has been used to determine the 10 demonstration cycles of d(3)(ii)(B) below. However, if a particular application should potentially involve more than one winch/hoist cycle per flight, then the number of demonstration cycles of d(3)(ii)(B) should be increased accordingly.

(A) A winch/hoist/rescue hook system level FMEA that identifies and minimizes any potential catastrophic failures should be conducted.

(B) Unless a more rational test method is presented and approved, a repetitive test of all functional devices in accordance with d(3)(vii) that exercises the entire system's functional parameters at least 10 times should be conducted. These repetitive tests may be conducted on the rotorcraft, or by using a bench simulation that accurately replicates the rotorcraft installation.

NOTE: If a more rational method of compliance is presented that clearly shows that an equivalent level of safety can be achieved in fewer than 10 system test cycles, the method of compliance is acceptable.

NOTE: For properly certified winch/hoist units (Ref. d(3)(i)) that have established acceptable service histories, full certification credit for the unit itself may be given. However, each new installation is required to be approved individually, unless the installation is either identical or similar to an existing approved installation with an acceptable service history. If the new installation is only similar to an acceptable existing installation, then, for a similarity approval, all differences should be clearly stated, rationalized, analyzed, and/or tested to show they do not adversely affect the new installation (i.e., equivalent safety should be provided).

(C) A winch/hoist unit environmental qualification program that includes consideration of high and low temperatures (typically -40F to +150F), altitudes to 12,000 feet, humidity, salt spray, sand and dust, vibration, shock, rain, fungus, and acceleration should be conducted. Testing should be conducted in accordance with RTCA/DO-160C and/or MIL-STD-810 for high and low temperature tests and for vibrations. The winch/hoist manufacturers should submit a test plan and follow-on test reports to the applicant and FAA following completion of qualification. It is intended that the winch/hoist itself either be prequalified to the EMI and lightning threat levels specified for NHEC and/or HEC or that it be qualified as part of the entire onboard QRS to these threat levels.

(D) All instructions and documents necessary for continued airworthiness should be provided.

(E) The methods of compliance in other relevant paragraphs of this AC or equivalent methods should be employed.

d(3) continued

(iii) HEC applications. The winch/hoist/rescue hook system should be reliable for the phases of flight in which it is operable, unstowed, partially unstowed and/or in which HEC is carried. The primary electrical and/or mechanical failure modes that should be identified and minimized are unintended load release by any means and loss of continued safe flight and landing capability due to a winch/hoist/rescue hook system failure. However, any other winch/hoist/rescue hook system failure that could lead to a catastrophic failure mode for the rotorcraft should also be minimized. The winch/hoist should be disabled (or an overriding, fail-safe mechanical safety device such as either a flagged removable shear pin or a load-lowering brake should be utilized) to prevent inadvertent load unspooling or release during any extended flight phases which involve HEC and in which winch/hoist operation is not intended. Loss of winch/hoist operational control should also be considered. The reliability of the system should be demonstrated by completion and approval of the following:

NOTE: It is assumed that only one winch/hoist cycle will typically occur per flight. This rationale has been used to determine the 30 demonstration cycles of d(3)(iii)(B) below. However, if a particular application should potentially involve more than one winch/hoist cycle per flight, then the number of demonstration cycles of d(3)(iii)(B) should be increased accordingly.

(A) A winch/hoist/rescue hook system level FMEA that identifies and minimizes any potential catastrophic failures should be conducted.

(B) Unless a more rational test method is presented and approved, a repetitive test of all functional devices in accordance with d(3)(vii) that exercises the entire system's functional parameters at least 30 times should be accomplished. These repetitive tests may be conducted on the rotorcraft or by using a bench simulation test that accurately replicates the rotorcraft installation.

NOTE: If a more rational method of compliance is presented that clearly shows that an equivalent level of safety can be achieved in fewer than 30 system test cycles, the method of compliance is acceptable.

NOTE: For properly certified winch/hoist units (Ref. d(3)(i)) that have established acceptable service histories, full certification credit for the unit itself may be given. However, each new installation is required to be approved individually, unless the installation is either identical or similar to an existing approved installation with an acceptable service history. If the new installation is only similar to an acceptable existing installation, then for a similarity approval, all differences should be clearly stated, rationalized, analyzed, and/or tested to show they do not adversely affect the new installation (i.e., equivalent safety should be provided).

(C) A winch/hoist system environmental qualification program that includes consideration of high and low temperatures (typically -40F to +150F), altitudes to 12,000 feet, humidity, salt spray, sand and dust, vibration, shock, rain, fungus, and acceleration should be conducted. Testing should be conducted in accordance with RTCA/DO-160C and/or MIL-STD-810 for high and low temperature tests and for vibrations. The winch/hoist manufacturers should submit a test plan and follow-on test reports to the applicant and FAA following completion of qualification. It is intended that the winch/hoist itself either be prequalified to the EMI and lightning threat levels specified for NHEC and/or HEC or that it be qualified as part of the entire onboard QRS to these threat levels.

(D) All instructions and documents necessary for continued airworthiness should be provided.

d(3) continued

(E) The methods of compliance in other relevant paragraphs of this AC or equivalent methods should be employed.

(iv) Cable attachment. Either the cable should be positively attached to the winch/hoist drum and the attachment should have ultimate load capability, or equivalent means should be provided to minimize the possibility of inadvertent, complete, cable unspooling.

NOTE: Even though the placarded winch/hoist system load rating is much less, most winch/hoist cables are rated to a minimum of 3,300 lbs limit load. Typically, cables have a neutral twist to minimize load oscillation.

(v) Cable length and marking. A length of cable nearest the cable's attachment to the winch/hoist drum should be visually marked to indicate to the operator that the cable is near full extension. The length of cable to be marked is a function of the maximum extension speed of the system and the operator's reaction time needed to prevent cable run out. It should be determined during certification demonstration tests. In no case should the length be less than 3 1/2 drum circumferences.

(vi) Cable stops. Means should be present to automatically stop cable movement quickly when the system's extension and retraction operational limits are reached.

(vii) Winch/hoist system load-speed combination ground tests. The load versus speed combinations of the winch/hoist should be demonstrated on the ground (either using an accurate engineering mock-up or a rotorcraft) by showing repeatability of the no load-speed combination, the 50 percent load-speed combination, the 75 percent load-speed combination and the 100 percent (i.e., system rated limit) load-speed combination. If more than one operational speed range exists, the preceding tests should be performed at either all speeds, or at the most critical speed if it can be determined. [Reference d(3)(ii)(B) and d(3)(iii)(B)].

(A) At least 1/10 of the demonstration cycles (see definition) should include the maximum aft angular displacement of the load from the drum, applied for under § 29.865(a).

(B) A minimum of six consecutive, complete operation cycles should be conducted at the system's 100 percent (i.e., system limit rated) load-speed combination.

(C) In addition, the demonstration should cover all normal and emergency modes of intended operation and should include operation of all control devices such as limit switches, braking devices, and overload sensors in the system.

(D) All quick disconnect devices and cable cutters should be demonstrated at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of system limit load or at the most critical percent, if it can be determined.

NOTE: Some winch/hoist designs have built-in cable tensioning devices that function at the no load-speed combination, as well as at other load-speed combinations. This device should be demonstrated to work during the no load-speed and other load-speed cable-cutting demonstrations.

(E) All electrical and mechanical systems and load release devices for any jettisonable NHEC or HEC RLC should be shown to be reliable by both analysis and by testing done in accordance with the combined criteria of d(8) and this paragraph.

d(3) continued

(F) Any devices or methods used to increase the mechanical advantage of the winch/hoist should also be demonstrated.

(G) During a portion of each demonstration cycle, the winch/hoist should be operated from each station from which it can be controlled.

NOTE: A reasonable amount of starting and stopping during demonstration cycles is acceptable.

(viii) Winch/hoist system continued airworthiness. The design life of the winch/hoist system and any limited life components should be clearly identified, and the Airworthiness Limitations Section of the maintenance manual should include these requirements. For STC's, a maintenance manual supplement should be provided that includes these requirements.

NOTE: Design lives of winch/cable systems are typically between 5,000 to 8,000 cycles. One major manufacturer uses a specification requirement of 7,500 cycles. Some winch/hoist systems have usage time meters installed. Others may have cycle counters installed. Cycle counters should be considered for HEC operations and high load or other operations that may cause low-cycle fatigue failures (See also d(24)).

(ix) Winch/hoist system manual proofing. Operating manuals, flight manuals, maintenance manuals, and associated placards should be used and proofed during the demonstration.

(x) Winch/hoist system flight tests. An in-flight demonstration test of the winch/hoist system is required for helicopters designed to carry NHEC or HEC. The rotorcraft should be flown to the extremes of the applicable maneuver flight envelope and to all conditions that are critical to strength, maneuverability, stability, and control, or any other factor affecting airworthiness. Unless a lesser load is determined to be more critical for either dynamic stability or other reasons; the maximum winch/hoist system rated load or, if less, the maximum load requested for approval (and the associated limit load data placards) should be used for these tests. The minimum winch/hoist system load (or zero load) should also be demonstrated in these tests. (See also d(19)(x).)

(4) Compliance Procedures for Cargo Hooks (or Equivalent Devices) and their Related Systems under §§ 29.865(a), (b), and (c): Cargo hooks or equivalent devices and their related systems, used for any external cargo type, should be approved to acceptable aircraft industry standards. These standards and any related manufacturer's certificates of production/qualification, thereto, should be presented by the applicant as part of the approval package.

(i) General. Cargo hook systems should have the same reliability goals and should be functionally demonstrated under critical loads for NHEC, HEC, or both in a manner identical to winch/hoist/rescue hook systems (reference d(3)). All engagement and release modes should be demonstrated. If the hook is used as a quick-release device, then release of critical loads should be demonstrated under conditions that simulate maximum allowable bank angles and speeds and any other critical operating conditions. Demonstration of any relatch features and any safety or warning devices should also be conducted. Demonstration of actual in-flight emergency quick-release capability may not be necessary if the quick-release capability can be acceptably simulated by other means.

NOTE: Cargo hook manufacturers specify particular shapes, sizes, and cross sections for lifting eyes to ensure compatibility with their hook design (e.g., Breeze Eastern Service Bulletin CAB-100-41). Experience has shown that, under certain

d(4) continued

conditions, a load may inadvertently hang up because of improper geometry at the hook/eye interface that will not allow the eye to slide off an open hook as intended. See also the discussion of hook dynamic roll out (i.e., the converse-an unintentional load release) under d(8).

NOTE: Some cargo hook systems may employ two or more cargo hooks for fail safety (i.e., after a failure of any single hook the remaining system is capable of carrying limit load). These systems are approvable. However, loss of load by any single hook should be shown to not result in loss of control of the rotorcraft. In a dual hook system, if the hook itself is the quick-release device (i.e., if a single release point does not exist in the load path between the rotorcraft and the dual hooks), the pilot should have a dual PQRS that includes selectable, collocated individual quick releases that are independent for each hook used. A BQRS should also be present for each hook. For cargo hook systems with more than two hooks, either a single release point should be present in the load path between the rotorcraft and the multiple hook system or multiple PQRS/BQRS's should be present. The former arrangement would only require a single PQRS and BQRS. A single release point can be a single or multiple cable cutter or release.

NOTE: If possible (within the rotorcraft configuration's restrictions), a simple set of approved cable cutters can satisfy the requirement for either a PQRS or BQRS in a cargo hook system installation. However, in many cargo hook system installations, unless a special access panel or an equivalent means is present, a crewman typically cannot reach and cut the cable with a standard set of cable cutters.

(ii) NHEC cargo hook systems. For jettisonable NHEC applications, each cargo hook-

(A) Should have a sufficient amount of slack in the control cable to permit cargo hook movement without tripping the hook release.

(B) Should be shown to be reliable in a manner identical to winch/hoist systems under d(3)(ii).

(iii) HEC cargo hook systems. For jettisonable HEC applications, each cargo hook-

(A) Should have a sufficient amount of slack provided in the control cable to permit cargo hook movement without tripping the hook release.

(B) Each cargo hook should be shown to be reliable in a manner identical to winch/hoist systems under d(3)(iii).

(C) Unless the cargo hook is to be the primary quick-release device, each cargo hook should be designed such that the load cannot be inadvertently released by operationally induced loads. For example, a simple cargo hook should have a one-way, spring loaded gate (i.e., "snap hook") that allows load attachment going into the gate but does not allow the gate to open (and subsequently lose the HEC) when an operationally induced load is applied in the opposite direction. For HEC applications, cargo hooks that double as quick-release devices should be carefully reviewed to ensure they are reliable. Paragraph d(8)(iii) discusses means of increasing the reliability of devices such as cargo hooks for HEC applications.

(iv) Other cargo hook system safety requirements. DOE, EPA, OSHA, and other Government Agencies may have special safety requirements for cargo hook

d(4) continued

design over and above the FAR's, such as a dual cargo hook requirement for certain HEC operations under multi-agency regulation.

(5) Compliance Procedures for Maximum Limit Load Magnitude Determination for all Jettisonable RLC Applications under §29.865(a): For all jettisonable RLC applications for any applicable cargo type seeking § 29.865(a) approval, the maximum limit external load for which certification is requested (even though it may otherwise be much less than the maximum system capacity; e.g., cargo hook capacity, etc.) should not exceed the rated capacity of the QRS release devices used in the applicant's design or, for HEC, the rated capacity of either the QRS devices, the PCDS, or its attachments--whichever is less. Relevant parts of the QRS and the entire PCDS should be analyzed and strength tested, with FAA witness, or otherwise structurally substantiated to determine their allowable limit load capacity (reference (d)(2)) if not previously FAA approved or produced to a recognized, approvable industry and/or military standard.

(6) Compliance Procedures for Basic Loads Analysis under § 29.865(a): For all jettisonable RLC applications of any applicable cargo type seeking compliance with § 29.865(a), the maximum ultimate external load is required to be applied at sling-load-line to rotorcraft vertical axis (Z axis) angles up to 30 degrees, in any geometric direction, in substantiating analyses or tests. The 30-degree angle may be reduced in some or all directions if impossible to obtain due to physical constraints or operating limitations.

(i) Maximum cable angle. The maximum allowable cable angle (from either a winch/hoist/rescue hook, cargo hook system, or other acceptable system configuration) should be determined and approved (reference d(3)). The angle approval should be based on structural requirements, mechanical interference limits, and flight handling characteristics over the most critical conditions and combinations of conditions in the approved flight envelope.

NOTE: In an emergency, in some cases, the combined design of the rotorcraft and the suspended system may be such that the 30-degree angle can be exceeded, to a limited extent, without catastrophic failure. The flight manual should clearly state this maximum angle value (in the aft direction relative to the Rotorcraft Z axis; for both maximum and minimum cable lengths) that should never be exceeded in any emergency in order to minimize the hazard of a related, catastrophic failure.

(ii) 30 degree maximum angle value. In no case should the design angle for HEC exceed 30 degrees from the vertical rotorcraft axis (i.e., Z axis). If the angle is reduced, appropriate placards and flight manual changes are required (reference d(2)).

(iii) Special cases. In some special NHEC jettisonable RLC operations, such as wire stringing, the 30-degree angle can be exceeded. These cases should be approved on a case-by-case basis by an engineering certification office. An issue paper should be used to document the exact limit operational parameters determined during certification. This is necessary because of the large variability of external loads and flight maneuvers that should be considered to establish safe operating limits for these operations. As a minimum, the maximum allowable load, the maximum allowable cable angles, the maximum flight envelope, the necessary limitation placards, and the necessary RFM procedures/restrictions should be accurately determined and documented. The maximum allowable structural load envelope should be clearly identified and determined. The fatigue spectrum created by this load envelope and its frequency of use (considering in particular the possibility of low cycle fatigue failures and significantly reduced component life limits) should be clearly identified, documented, and approved.

All monetary values are expressed in 1996 dollars and are discounted to the time of initial certification application, at a rate of seven percent.

Proposed §§ 27.865(b)(3)(i) and 29.865(b)(3)(i)

Because of adverse service history and the need to specifically state the levels of safety for HEC and NHEC, these sections would require that both the primary and backup quick-release subsystems be reliable, durable, and functional. Reliability would be achieved by use of design features and by use of failure modes and effects analysis. Both reliability and durability would be demonstrated by use of repetitive functional tests. The costs of conducting reliability and durability tests are included in the $39,000 average certification and design cost estimate in Table 1.

Proposed §§ 27.865(b)(3)(ii) and 29.865(b)(3)(ii)

These sections would require protection of the quick-release subsystems against potential internal and external sources of electromagnetic interference (EMI) and lightning. This new requirement is necessary to prevent inadvertent jettison of NHEC and HEC from sources such as stray electromagnetic signals, static electricity, and lightning strikes. Proposed field intensity levels are 200 volts per meter for applicable portions of QRS used for HEC and 20 volts per meter for applicable portions of QRS used for

(d)6 continued

NOTE: There are two typical configurations that have been previously approved for attaching jettisonable NHEC loads in operations such as wire stringing. They are:

Weighted-Line Sidepull Configuration. In this method, a heavy dead weight is suspended below the cargo hook. The sidepull line (jettisonable load) is then attached to the dead weight or just above the weight. The rotorcraft then proceeds in forward or sideward flight and the weight pulls the sidepull-line (jettisonable load). This method is very inefficient for payload utilization since much of the rotorcraft load capacity is used to move the dead weight rather than pulling the sidepull line. Load limiting devices such as approved fuseable/frangible links should be considered for these applications to ensure limit load is not exceeded in service.

Sidepull-Fixture Sidepull Configuration. In this method, a QRS device is attached at the side of the rotorcraft (or in another equivalently functional location) and is arranged so the sidepull-line's (jettisonable load's) load path is through (or nearly through) the rotorcraft center of mass at a typical working fuel condition. This configuration is more payload efficient and has much better controllability characteristics than the deadweighted sidepull-line configuration. At least one STC has been issued for a sidepull-fixture configuration for use in operations.

(7) Compliance Procedures for General QRS Certification and Installation under § 29.865(b) and § 29.865(c): For jettisonable RLC's for any applicable cargo type, a PQRS is mandated that features an approved primary quick-release device to be installed on one of the pilot's primary controls, or in an equivalently accessible location. The use of an "equivalent accessible location is intended to be applied reviewed on a case-by-case basis and to be used only where equivalent safety is clearly maintained. A BQRS with a backup quick-release device is also required. The PQRS, the BQRS, and their load release devices and subsystems (such as electronically actuated guillotines) should be separate (i.e., physically, systematically, and functionally redundant). Also, for the BQRS, the backup release control and release need not be mechanical. It is intended that less sophisticated BQRS's and load release devices (such as manual cable cutters) would, if separate, be acceptable. However, if separate devices of this type are to be used, they should be listed in the flight manual as a required device and have a dedicated, placarded storage location. Each quick-release device should be designed and located to allow the pilot or a crewmember to accomplish external cargo release without hazardously limiting the ability to control the rotorcraft during emergency situations. The flight manual should reflect the requirement for a crewmember and the related functions. For jettisonable HEC operations, further QRS requirements are contained in § 29.865(c). (See paragraphs d(8), d(9) and d(12) of this AC.) No PQRS or BQRS should require more than 30 seconds from the time an emergency is declared and the PQRS or BQRS quick release device is located and activated until the NHEC or HEC load is released. This should be clearly demonstrated in certification.

(8) Compliance Procedures for Reliability Determination for Jettisonable NHEC and HEC QRS's and Devices under § 29.865(b)(3): Jettisonable NHEC QRS's and devices and jettisonable HEC QRS's and devices are required to be reliable. One acceptable method of achieving the intended reliability goals is described as follows:

NOTE: For both NHEC and HEC designs, the phenomena of hook dynamic roll out should be considered, to the maximum practicable extent, to ensure that QRS reliability goals are not compromised. This is of utmost concern for HEC applications. Hook dynamic roll-out occurs during certain ground handling and flight conditions that may allow the lifting eye to work its way out of the hook (Reference Figure 1).

d(8) continued

Some commercial hook shape and keeper designs are quite prone to hook dynamic roll-out. Military Standard hook designs have not been as prone to hook dynamic roll-out as have some commercial designs. Hook dynamic roll-out typically occurs when either the RLC's sling or harness is not properly attached to the hook, is blown by down draft, is dragged along the ground, is dragged through the water; or is otherwise placed into the dangerous hook/eye configuration, shown by Figure 1. This can occur during ground handling or can be caused by relative motion of the hook and eye in flight. The potential for hook dynamic roll-out can be minimized in design by specifying particular hook-and-eye shape and hook-and-eye cross-section combinations. For non-jettisonable RLC's, a push-pull pin (or an equivalent device) can be used to lock the hook keeper in place during operations. The hook dynamic roll-out service history of any off-the-shelf components to be utilized should also be reviewed to minimize the use of potential "bad-actors."

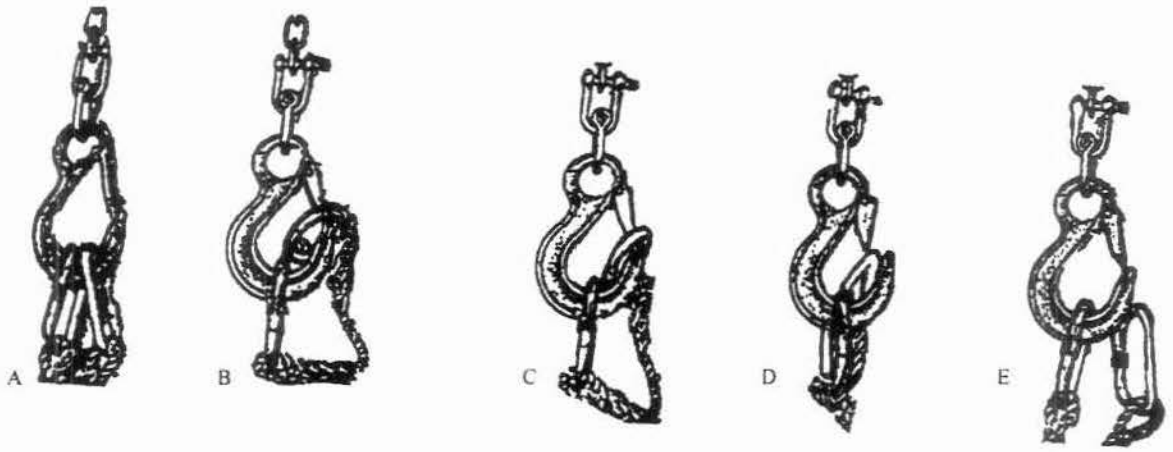


FIGURE 1: SEQUENTIAL SIMULATION OF HOOK DYNAMIC ROLL-OUT

(i) Jettisonable NHEC designs. The QRS and the load suspension and retention designs should be reliable. The primary electrical and/or mechanical failure modes that should be identified and minimized are load release by any means and loss of continued safe flight and landing capability due to a QRS failure. However, any other failure that could lead to a catastrophic failure mode for the rptorcraft and its occupants should also be identified and minimized. The reliability of the system should be demonstrated by completion and approval of the following:

d(8) continued

(A) A QRS level FMEA that identifies and minimizes any potential catastrophic failures.

(B) A repetitive test of all functioning devices that affect or comprise the QRS and that tests all critical conditions or combinations of critical conditions at least 10 times each, using both the primary and backup QRS subsystems.

(C) An environmental qualification program such as that described in d(3)(ii)(C).

(D) Use of the methods of compliance in other relevant paragraphs of the AC or equivalent methods.

(ii) Jettisonable HEC designs. The QRS and the load suspension and retention designs should be reliable. The primary electrical and/or mechanical failure modes that should be identified and minimized are unintended load release by any means and loss of continued safe flight and landing capability due to a QRS failure. However, any other failure that could lead to a catastrophic failure for the rotorcraft and its occupants (either internal, external, or both) should also be identified and minimized. The reliability of the system should be demonstrated by completion and approval of the following:

(A) A QRS level FMEA that identifies and minimizes all failure modes, including any potential catastrophic failures.

(B) A repetitive test of all functioning devices that affects or comprises the QRS and that tests all critical conditions or combinations of critical conditions at least 30 times each, using both the primary and backup subsystems.

(C) An environmental qualification program such as that described in d(3)(ii)(C).

(D) Use of the methods of compliance in other relevant paragraphs of the AC or equivalent methods.

(iii) Special Cases. In some cases, an acceptable reliability for jettisonable HEC operations can be shown by temporarily deactivating a particular QRS, PQRS, and/or BQRS subsystem used for NHEC that is not otherwise reliable enough for use with jettisonable HEC. For example, this could be accomplished by adding an approved reliable QRS device for HEC such as alternate, ultimate load path across a relatively low reliability, jettisonable NHEC quick-release device or by adding another reliable fail-safe device (e.g., adding an approved, reliable safety strap as a parallel ultimate load path). The same reliability goal for HEC use could also be achieved by adding another, reliable fail-safe device such as a safing pin to an electronically actuated guillotine cutter to upgrade the system reliability to be acceptable for HEC carriage. For some designs, cargo hooks can be made more reliable by wiring them shut with an approved gage of safety wire. All other regulatory requirements for HEC carriage must still be met after an approved modification of the QRS to achieve the reliability necessary for HEC carriage. In the preceding examples, a replacement PQRS such as an additional set of cable cutters would need to be added to provide a complete QRS (i.e., both the PQRS and the BQRS must be present). In all cases, an HEC reliability demonstration in accordance with d(8)(ii) should be conducted and approved. Operational acceptability of these special case configurations also needs to be demonstrated.

d(8) continued

(iv) Other load release types. In some current configurations, such as those used for high line operations, a load release may be present that is not on the rotorcraft but is on the PCDS itself. Examples are a tension release device that lets out line under an operationally induced load or a personal rope cutter. These devices are acceptable if:

(A) The off-rotorcraft release is considered a "third release"; i.e., an approved QRS (i.e., PQRS and BQRS) is present on the rotorcraft;

(B) The release meets other relevant requirements of § 29.865 and the methods of this AC or equivalent methods; and

(C) The release has no operational or failure modes that would affect continued safe flight and landing under any operations, critical failure modes, conditions, or combination of either.

(9) Compliance Procedures for Electromagnetic Interference under § 29.865(b)(3)(i): Protection of any critical portions of the QRS against potential internal and external sources of electromagnetic interference (EMI) and lightning is required. This is necessary to prevent inadvertent load release from sources such as lightning strikes, stray electromagnetic signals, and static electricity.

NOTE 1: For "on-the-shelf" QRS system components (that may be used on different rotorcraft and in different installation configurations in the same rotorcraft) a one-time bench test, if FAA approved, can be used to test the EMI capability of the component itself. However, the EMI effect of each individual installation must be taken into account on a case-by-case basis when certifying the component's installation. This is especially critical for HEC applications.

(i) Jettisonable NHEC systems - should be able to absorb a minimum of 20 volts per meter (i.e., CAT U) RF field strength per RTCA/DO-160C.

(ii) Jettisonable HEC systems[1] - should be able to absorb a minimum of 200 volts per meter (i.e., CAT Y) RF field strength per RTCA/DO-160C.

NOTE 1: These RF field threat levels may have to be increased for certain special applications such as microwave tower and high voltage high line repairs. Separate criteria for special applications under multi-agency regulation (such as IEEE/OSHA standards) should also be addressed, as applicable, during certification. When necessary, an issue paper can be used to establish a practicable level of safety for specific high voltage or other special application conditions. For any devices or means added to meet multi-agency regulations, their failure modes should not have an adverse effect on flight safety. Other certification authorities may require higher RF field threat levels than those required by § 29.865 (e.g., the European Joint Aviation Authorities Interim HIRF policy).

NOTE 2: An approved, standard rotorcraft test that includes the full HIRF frequency/amplitude external and internal environments on the QRS and PCDS (or the entire rotorcraft including the QRS and PCDS) could be substituted for the jettisonable NHEC and HEC systems tests defined by d(9)(i) and d(9)(ii), respectively, as long as the RF field strengths directly on the QRS and PCDS are shown to equal or exceed those of d(9)(i) and d(9)(ii).

NOTE 3: The EMI levels specified in d(9)(i) and d(9)(ii) are total EMI levels to be applied to the QRS (and/or effected QRS component) boundary. The total EMI level applied should include the effects of both external EMI sources and internal EMI sources. All aspects of internally generated EMI should be carefully considered

d(9) continued

including peaks that could occur from time-to-time due to any combination of on-board systems being operated. For example, special attention should be given to EMI from winch operations that involve the switching of very high currents. Those currents can generate significant voltages in closely spaced wiring that, if allowed to reach some squib designs, could activate the device. Shielding, bonding and grounding of wiring associated with operation of the winch and the quick-release mechanism should be clearly and adequately evaluated in design and certification. This evaluation may require testing. One acceptable test method to demonstrate adequacy of QRS shielding, bonding and grounding, would be to actuate the winch under maximum load together with likely critical combinations of other aircraft electrical loads and demonstrate that the test squibs (that are more EMI sensitive than the squibs specified for use in the QRS) do not inadvertently operate during the test.

(10) General Compliance Procedures for HEC Applications under § 29.865(c): For HEC applications, the safety requirements for HEC carriage for all applicable RLC's are addressed. This ensures that HEC certification requirements are clearly and properly identified.

(11) General Compliance Procedures for Jettisonable HEC Operations under § 29.865(c)(1): For jettisonable HEC operations, it is required in conjunction with Operations Requirements, that the rotorcraft meet the Transport Category A engine isolation requirements of Part 29 and that the rotorcraft have OEI OGE hover performance capability in its approved, jettisonable HEC weight, altitude, and temperature envelope. OEI vertical climb capability may be needed in some operational circumstances for flight safety. Such instances should be identified and the necessary OEI vertical climb capability assessed and verified during the certification process.

(12) Compliance Procedures for QRS's under § 29.865(c)(1): For jettisonable HEC operations, both the PQRS and BQRS are required to have a DAD (i.e., see definitions, they are required to have a sequential control with two distinct actions) for external cargo release. Two distinct actions are required to provide a higher level of safety to minimize inadvertent jettison of HEC. The DAD is intended for emergency use only during the phases of flight that the HEC is carried (and/or retrieved) externally. The DAD can be used for both NHEC and HEC operations. However, because it can be used for HEC, its continued airworthiness should be carefully reviewed and documented in accordance with prescribed (or mandated) instructions. The DAD (i.e., either the primary or backup release) can be operated by the pilot from a primary control or, after a command is given by the pilot, by a crewmember from a remote location. If the backup DAD is a cable cutter, it should be properly secured but readily accessible to the crewmember intended to use it.

NOTE 1: OEI power settings should not be used for certification credit for normal operations. However, they are available for the OEI emergency scenarios for which approval has been granted whether or not a NHEC or HEC is involved. For determination of the maximum rotorcraft gross weight approved for Class D operations (i.e., HEC operations performed with a multiengine rotorcraft capable of OEI HOGE), it is intended that use of the maximum OEI Power approved for the rotorcraft engine and drive system be allowed after failure of the critical engine (when applied in conjunction with an approved Class D operating procedure). Thus, it would be acceptable to base the required OEI/OGE hover performance capability for a Class D operation on a 30-second OEI power rating if the operator can demonstrate that the HEC can be safely transitioned to a flight condition where the HEC can be retrieved inside the rotorcraft for an execution of a normal OEI landing. If the specific operation for which the Class operation approval is requested does not provide for

d(12) continued

safe disposition of the HEC when using a time limited OEI rating, the Class D operation gross weight should be limited to a gross weight where OEI/OGE hover capability can be demonstrated for a continuous time period.

(13) Compliance Procedures for PCDS's under § 29.865(c)(2): For all HEC applications, an approved PCDS is required. The PCDS is either required to be previously approved or is required to be approved during certification (reference d(14) for information on current designs). In either case, its installation should be approved. PCDS designs can vary from simple single occupant donut "lifesaver" devices to relatively complex multiple occupant cages or gondolas. However, the basic occupant hazard design philosophy is the same. It is to provide injured (conscious or possibly unconscious) occupants or uninjured occupants the level-of-safety necessary to minimize the possibility of any further or new injuries under any flight conditions that could occur while they are carried external to the rotorcraft.

(i) Static strength. The PCDS should be substantiated for the allowable ultimate load and loading conditions as determined under paragraphs d(2) through d(5) above.

(ii) Fatigue. The PCDS is required to be substantiated for fatigue in accordance with § 29.865(f) (Reference d(21)).

(iii) Personnel safety. For each PCDS design, a documented design evaluation should be submitted by the applicant (and presented to the Certification Authority) that ensures that the necessary level of personnel safety is provided (i.e., all potential, relevant occupant hazards are acceptably minimized). As a minimum, the following should be evaluated.

NOTE: It is intended that the evaluation should be comprehensive. However, it is not necessarily intended that the PCDS be required to have all the personnel safety design features of, for example, a transport aircraft interior. Only those personnel safety design features necessary to minimize new or further injury to PCDS occupants during the relatively short time interval the PCDS is utilized on a given mission are necessary.

(A) The PCDS should be easily and readily ingressed or egressed.

(B) It should be placarded for proper capacity, internal arrangement/location of occupants, and ingress and egress instructions (See also, d(2)(vi)).

(C) For door latch fail-safety, more than one fastener or closure device is recommended. The latch device design should provide direct visual inspectability to ensure it is fastened and secured.

(D) Any fabric used should be durable and should meet relevant flammability standards.

(E) Safety harnesses and belts should meet TSO C-22 and TSO-C-114 requirements.

(F) Sharp corners and edges should be avoided and padding should be used, as necessary, to protect the occupants.

d(13) continued

NOTE: Acceptable sources of detailed design criteria and standards for PCDS webbing and harness can be found in sources such as U.S. AAVSCOM TR 89-D-22D, "Aircraft Crash Survival Design Guide, Volume IV - Aircraft Seats, Restraints, Litters, and Cockpit/Cabin Delethalization."

(G) Occupant retention devices and related design safety features should be used as necessary. In simple designs, only a lack of sharp corners and edges with adequate strapping (or other means of HEC retention relative to the PCDS) and head supports/pads may be all the safety features that are necessary. However, in more complex PCDS designs, safety features such as seat belts, hand holds, shoulder harnesses, placards, and/or other personnel safety standards may be required.

(H) Use of methods of compliance in other relevant paragraphs of this AC or equivalent methods.

(iv) Reliability. The reliability level goal for the PCDS and its attachments to the rotorcraft is extremely improbable (i.e., 1×10^{-9} failures per flight) for all failure modes that could cause either catastrophic failure, serious injuries, and/or fatalities anywhere in the total airborne system. All significant failure modes of lesser consequence should be rendered improbable (i.e., 1×10^{-5} failures per flight). One acceptable method of achieving this goal is to submit and achieve approval of the following:

(A) A PCDS level FMEA that minimizes any potential catastrophic failures that are not extremely improbable and minimizes any other lesser, significant failures that are not improbable.

(B) A repetitive test of all functional devices that cycles these devices under critical structural conditions, operational conditions, or a combination at least 30 times.

(C) An environmental qualification review over the proposed operating environment.

NOTE: A complete environmental qualification test as described in d(3)(iii)(C) is necessary unless the design features would clearly not necessitate employment of all or part of the test program of d(3)(iii)(C).

(v) EMI and lightning protection. All essential, affected components of the PCDS, such as intercommunication equipment, should be protected against RF field strengths to a minimum of RTCA/DO-160C CAT Y. (Reference d(9)(ii).)

(vi) Continued airworthiness. All instructions and documents necessary for continued airworthiness, normal operations, and emergency operations should be completed, reviewed, and approved during the certification process.

(vii) Flotation devices. PCDS's that are intended to have a dual role as floatation devices or life preservers should meet the requirements of TSO-C13f, "Life Preservers." Also, any PCDS design to be used in the water should have a floatation kit. The kit should support the weight of the maximum number of occupants and the PCDS in the water and minimize the possibility of the occupants floating face down.

(viii) Aerodynamic considerations. Litters and other types of PCDS designs may (because of effects from sources such as down drafts, maneuvers, or

d(13) continued

gusts) spin, twist or otherwise respond unacceptably in flight. These designs should be structurally restrained with devices such as a spider, a harness, or an equivalent device to minimize undesirable flight dynamics.

(ix) Medical design considerations. The PCDS should be designed to the maximum practicable extent and placarded to maximize the HEC's protection from medical considerations such as blocked air passages induced by improper body configuration and excessive loss of body heat during operations. HEC (especially injured and/or water soaked persons) may be exposed to high body heat loss from sources such as rotor wash and the airstream. PCDS occupant safety from transit induced medical considerations can be greatly increased by proper design.

(x) Special PCDS configurations. Certain PCDS configurations may be submitted for approval that have special design considerations. Known configurations and their special design considerations are described, as follows:

(A) Net type PCDS's. A well-designed net type PCDS has the advantage of being able to quickly evacuate several combinations of able and/or disabled HEC. Net type PCDS's should be designed such that enough rigid or semi-rigid components are present so that the net does not close in and entrap, injure, further injure, and/or create panic from claustrophobia to the HEC occupants during rescue. Secondly, if intended for water use, the net type PCDS should have proper flotation so it does not drag the HEC underwater. Thirdly, the net type PCDS should be easily ingressed so that the HEC will readily climb into the net and not try to hang onto the outside of the net.

(14) Summary of Current PCDS Designs that relate to § 29.865(c)(2): In relation to § 29.865(c)(3), several commercial and military PCDS's exist and are used for emergency rescue work involving HEC. Known devices are summarized in Table 373-2. Some devices are not approved; however, applications that involve them may be submitted for approval.

(15) Compliance Procedures for QRS Design, Installation, and Placarding under § 29.865(c)(3): For jettisonable HEC applications, the QRS design, installation, and associated placarding should be given special consideration to ensure the proper level of occupant safety.

(16) Compliance Procedures for Intercom Systems for HEC Operations under § 29.865(c)(4): For all HEC operations, the rotorcraft is required to be equipped for or otherwise allow direct intercommunication under any operational conditions among crewmembers and the HEC. It is intended that for simple systems, voice or hand signals to PCDS occupants (if not in conflict with operations requirements) would be acceptable. In more complex systems, it is intended that more sophisticated devices such as intercoms be provided.

(17) Compliance Procedures for Flight Manual Procedures and Limitations for HEC Operations under § 29.865(c)(5) and (c)(6): All appropriate flight manual procedures and limitations for all HEC operations are required to be present and to be approved. These instructions and manuals should be proofed during flight tests (Reference d(19)).

(18) Compliance Procedures for Special Conditions Encountered in Operations: If special conditions will be encountered in operations such as low visibility and night use, then provisions such as night lighting that provide the proper level of safety for both the rotorcraft and HEC when operating under these special conditions should be identified, considered, and approved during certification. This determination should be made on a case-by-case

d(18) continued

basis during either initial or supplemental certification using the proposed operating environment scenario.

(19) Compliance Procedures for Flight Test Verification Work under § 29.865(d): Flight test verification work (or an equivalent combination of analysis and ground testing) conducted either in conjunction with or in addition to the flight tests required by operations rules (such as Part 133 for the U.S.) that thoroughly examines the operational envelope should be conducted with the external cargo carriage device for which approval is requested. The flight test program should show that all aspects of the operations applied for are safe, uncomplicated, and can be conducted by a qualified flight crew under the most critical service environment and under emergency pressure. Flight tests should be conducted for the simulated representative NHEC and HEC loads being applied for to demonstrate their in-flight handling and separation characteristics for normal flight conditions. In addition, emergency float conditions should be analyzed and/or tested to assure that the QRS will function properly during any emergency reasonably expected to occur in service. Normally, release during or following in-flight emergencies can be evaluated by analyses or ground tests. Actual flight test of release following a simulated engine failure may be required if the release conditions cannot be adequately simulated by ground test or analysis.

(i) General. Flight testing (or an equivalent combination of analysis and testing) should be conducted under the critical combinations of configurations and operating conditions for which basic type certification approval is sought. Additional combinations of external load and operating conditions may be subsequently approved under relevant operational requirements as long as the structural limits and reliability considerations of the basic certification approval are not exceeded (i.e., equivalent safety is maintained). The qualification flight test work of this subparagraph is intended to be accomplished primarily by analysis and/or bench testing. However, at least one in-flight, limit load drop test should be conducted for the critical load case. If one critical load case cannot be clearly identified, then more than one drop test might be necessary. Also, in-flight tests for the minimum load case (i.e., typically the cable hook itself) with the load trailing both in the minimum and maximum cable length configurations should be conducted. Any safety-of-flight limitations should be documented and placed in the rotorcraft flight manual. Also, in certain low-gross weight, jettisonable HEC configurations, the PCDS may act as a trailing airfoil (i.e., exhibit lift characteristics above certain airspeeds) that could result in entangling the PCDS and the rotorcraft. These configurations should be assessed on a case-by-case basis by analysis and/or flight test to assure any safety-of-flight limitations are clearly identified and placed in the rotorcraft flight manual.

(ii) Determination of one engine inoperative (OEI) hover performance. FAR 29.865(c)(6) and 133.45(e)(1) require the rotorcraft to be type certificated under Transport Category A for the operating weight and provide hover capability with one engine inoperative at that operating weight, altitude, and temperature. It is intended that the rotorcraft be able to withstand an engine failure during hover and continue the hover operation.

In determining OEI hover performance, dynamic engine failures should be considered. Each hover verification test should begin from a stabilized hover at the maximum OEI hover weight, at the requested in-ground effect (IGE) or out-of-ground-effect (OGE) skid/wheel height, and with all engines operating. At this point, the critical engine should be failed and the aircraft should remain in a stabilized hover condition without exceeding any rotor limits or engine limits for the operating engine(s). As with all performance testing, engine power should be limited to minimum specification power. Engine failures may be simulated by rapidly moving the throttle to idle provided a needle split is obtained between the rotor and the engine RPM.

Normal pilot reaction should be used following the engine failure to maintain the stabilized hover flight condition. When hovering OGE or IGE at maximum OEI hover weight, an engine failure should not result in an altitude loss of more than 10 percent or 4 feet, whichever is greater, of the altitude established at the time of engine failure. In either case, sufficient power margin should be available from the operating engine(s) to regain the altitude lost during the dynamic engine failure and to transition to forward flight.

The time required to recover an external load (especially HEC loads) and to transition to forward flight should also be considered. This time increment may limit the use of short duration, OEI power ratings. For example, for a helicopter that sustains an engine failure at a height of 40 feet, the time required to restabilize in a hover, recover the external load (given hoist speed limitations), and then transition to forward flight (with minimal altitude loss) would likely preclude the use of 30-second engine ratings and may encroach upon 2 1/2-minute ratings.

In addition, for those helicopters that incorporate engine driven generators, the hoist should remain operational following an engine/generator failure. A hoist should not be powered from a bus that is automatically shed following the loss of an engine/generator. Maximum two engine generator loads should be established such that when one engine/generator fails, the remaining generator can assume the entire rotorcraft electrical load (including maximum hoist electrical load) without exceeding approved limitations.

The Rotorcraft Flight Manual (RFM) should contain information that describes the expected altitude loss, any special recovery techniques, and the time increment needed for recovery of the external load when establishing maximum weights and skid heights. The OEI hover chart may be placed in the performance section of the RFM or RFM supplement. Allowable altitude extrapolation for the hover data should not exceed 2,000 feet.

(iii) Separation characteristics of jettisonable external loads. For any RLC for any applicable cargo type for which certification is requested, satisfactory post-jettison separation characteristics of representative loads should meet the minimum criteria that follow:

(A) Immediate "clean" operation of the QRS, including "clean" separate functioning of the PQRS and BQRS.

(B) No damage to the helicopter during or following actuation of the QRS and load jettisoning.

(C) A jettison trajectory clear of the helicopter.

(D) No inherent instability of the jettisonable (or just jettisoned) HEC and/or NHEC while in proximity to the helicopter.

(E) No adverse or uncontrollable helicopter reactions at the time of jettison.

(F) Stability and control characteristics after jettison should be within the originally certified limits.

TABLE 373-2

DEVICE	FAA APPROVED[2]	SOURCE
Stokes litter (one person)	No	U.S. Coast Guard
Rescue Basket	No	U.S. Coast Guard
Rescue Sling (one person)[1]	Yes	U.S. Coast Guard
Rescue Net (STC7586SW)[2]	Yes	Billy Pugh Co., Inc. P.O. Box 802 1415 N. Water Street Corpus Christi, TX 78403
LII (STC7731SW)[2]	Yes	Life Industries International, Inc. 4170 Rogers Avenue Suite D, Box 3284 Fort Smith, AR

NOTES:

1. The "rescue sling" or "rescue strop" is a "horse collar" device that requires a person to exert some effort to remain in the collar. Some versions of the rescue sling have retainer straps to help secure an occupant in the horse collar. These straps are typically located in pockets on each side of the collar and are usually marked "pull." The straps go around the occupant's back and clip together with a "V" ring and a quick ejector fitting. This device should only be used on a fully conscious individual, unless the individual is fully retained by devices such as retention straps. Even an alert, well-trained individual may have nerves impinged on by pressure from this device. Nerve impingement may result in loss of sensation in the arms, loss of grip, and inadvertent fall from the harness. The retainer strap version of the rescue sling should only be used in conjunction with properly written instructions and placards and with trained personnel.

2. FAA approval is for a specific installation only; each new installation is required to still be approved.

3. Other types of emergency rescue devices that are not listed but have been successfully used by the military are the Screamer Suit and the Jungle Penetrator. The screamer suit or harness (full body fishnet) is a PCDS constructed of mesh and webbing. It was originally designed to physically encompass the torso of HEC rescue subjects who are disabled or unconscious to prevent them from inadvertently falling out of the PCDS. It is a relatively simple device for a rescuer to use. The Jungle Penetrator is a heavy device (typically metal) with a tapered end. It will break light timber and brush when dropped in free-fall from the rotorcraft to an evacuee. It typically has arms that swing down on which HEC can ride and a webbing loop to hold the HEC onto the device.

d(19) continued

(G) No unacceptable degradation of the helicopter performance characteristics after jettison.

(iii) Jettison requirements for jettisonable external loads. For any applicable cargo type, emergency and normal jettison of all loads should be demonstrated (by a combination of analysis, ground tests, and flight tests) at sufficient combinations of flight conditions to establish, verify, and place in the flight manual a jettison envelope for each RLC and cargo type applied for.

(iv) QRS demonstration. Repetitive jettison demonstrations should be conducted that use the PQRS. Except, the BQRS should be utilized at least once.

(v) QRS reliability (i.e., failure modes) affecting flight performance. The FMEA of the QRS (reference d(7) and d(8)) should show that any single system failure will not result in unsatisfactory flight characteristics. For any QRS failures resulting in asymmetric loading conditions, the helicopter should be shown to be safely flyable. Performance characteristics should not be adversely affected by any QRS failure mode.

(vi) Flight test weight and CG locations. All flight tests should be conducted at the extreme or critical combinations of weight and longitudinal and lateral CG conditions within the applied for flight envelope. The rotorcraft should remain within approved weight and CG limits both with the external load applied and after jettison of the load.

(vii) Flight Speed Envelopes. Emergency and normal jettison demonstrations should be performed at sufficient airspeeds to establish any airspeed restrictions for satisfactory separation characteristics. The maximum and minimum airspeed limits for safe separation should be determined. The sideslip envelope as a function of airspeed should be determined.

(viii) Altitude. Emergency and normal jettison demonstrations should be performed at altitudes consistent with the approvable operational envelope and with the maneuvering requirements necessary to overcome any adverse effects of the jettison.

(ix) Attitude. Emergency and normal jettison demonstrations should be performed from all attitudes appropriate to normal and emergency operational usage. Where the attitudes of HEC and/or NHEC with respect to the helicopter may be varied, the most critical attitude should be demonstrated. This demonstration would normally be accomplished by bench testing.

(x) Winch/hoist/rescue hook systems and/or cargo hook systems. These articles should be flight demonstrated per d(3)(x).

(20) Compliance Procedures for External Loads Placards and Markings under § 29.865(e): Placards and markings should be installed next to the external load attaching means, in a clearly noticeable location, that state the primary operational limitations - specifically including the maximum authorized external load. Not all operational limitations need be stated on the placard (or equivalent markings) only those clearly necessary for immediate reference in operations. Other more detailed and/or operational limitations of lesser immediate reference need

d(20) continued

should be stated either directly in the RFM or in a supplement thereto (See also, d(2)(vi)).

(21) Compliance Procedures for Fatigue Substantiation under § 29.865(f): The fatigue evaluation of § 29.571 is required to be applied as follows:

NOTE: The term "hazard to the rotorcraft" is defined to include all hazards to either the rotorcraft, to the occupants thereof, or both.

(i) Fatigue evaluation of NHEC applications. Any critical components of the suspended system and its attachments (such as the cargo hook or bolted or pinned truss attachments), the failure of which could result in a hazard to the rotorcraft, would require an acceptable fatigue analysis in accordance with AC 20-95, Section 9(h).

(ii) Fatigue evaluation of HEC applications. The entire PCDS and its attachments should be reviewed on a component-by-component basis to determine which, if any, components are fatigue critical or damage intolerant. These components should be analyzed and/or tested (per AC 20-95) to ensure their fatigue life limits are properly determined and placed in the limited life section of the maintenance manual.

(22) Compliance Procedures for Agricultural Installations (AI's): AI's can be certified for either jettisonable or non-jettisonable NHEC or HEC operations as long as they meet relevant certification and operations requirements and follow appropriate compliance methods. However, most current AI designs are external fixtures (see definition) - not external loads. External fixtures are not certifiable as jettisonable external cargo because they do not have a true payload (see definition), true jettison capability (see definition), or a complete QRS. Many AI designs can dump their solid or liquid chemical loads by use of a "purge port" release over a relatively long time period (i.e., greater than 30 seconds). This is not considered true jettison capability (see definition) since the external load is not released by a QRS and since the release time span is typically greater than 30 seconds (reference c(20) and d(7)). Thus, these types of AI's should be certified as a non-jettisonable external load. However, other designs that have the entire AI (or significant portions thereof) attached to the rotorcraft, that have short time frame jettison (or release) capability provided by a QRS that meets the definitions herein and that have no post-jettison characteristics that would endanger continued safe flight and landing may be certified as a jettisonable external load. For example, if all the relevant criteria are properly met, a jettisonable fluid load can be certified as a NHEC external cargo. Paragraph 785 of this AC discusses other AI certification methodology.

(23) Compliance Procedures for External Tank Configurations: External tank configurations that have true payload (see definition) and true jettison capability (see definition) should be certified as jettisonable NHEC. External tank configurations that have a true payload capability but do not have true jettison capability should be certified as non-jettisonable NHEC. An external tank that has neither a true payload capability nor true jettison capability is an external fixture; it should not be certified under § 29.865 (i.e., as an external load). If an external tank is to be jettisoned in flight, it should have a QRS that is approved for the maximum jettisonable external tank payload and is either inoperable

d(23) continued

or is otherwise rendered reliable to minimize inadvertent jettisons above the maximum jettisonable external tank payload.

(24) Compliance Procedures for Logging operations: These operations are very susceptible to low-cycle fatigue because of the large loads and relatively high load cycles that are common to this industry. It is recommended that load measuring devices (such as load cells) be used to ensure that no unrecorded overloads occur and to ensure that cycles producing high fatigue damage are properly accounted for. Cycle counters are recommended to ensure acceptable cumulative fatigue damage levels are identifiable and are not exceeded. As either a supplementary method or alternate method, maintenance instructions should be considered to ensure proper cycle counting and load recording during operations.

(25) Compliance Procedures for Noise Certification: FAR 36 is the noise certification standard. Section 36.1(a)(4) specifically exempts helicopters that are designed exclusively for agricultural work, carrying firefighting materials, or external loads activity from the noise standards. FAR 21.93(b)(4) also contains specific information regarding external loads and what configurations constitute/do not constitute an acoustical change.

(26) Compliance Procedures for Inspection and Maintenance Considerations. Maintenance manuals (and supplements thereto) developed by applicants for external load applications should be presented for approval and should include all appropriate inspection and maintenance procedures. The applicant should provide sufficient data and other information to establish the frequency, extent, and methods of inspection of critical structure, systems and components thereof. This information must be included in the maintenance manual as required by § 29.1529. For example, maintenance requirements for sensitive QRS squibs should be carefully determined, documented, approved during certification, and included as specific mandatory scheduled maintenance requirements that may require either "daily" or "pre-flight" checks (especially for HEC applications).

TABLE 373-3: SUMMARY OF RELEVANT INFORMATION FOR U.S. PART 133 ROTORCRAFT LOAD COMBINATIONS CERTIFIABLE UNDER § 29.865

Basic Definition and Intended Use	Typical Load Limits	Quick Release Requirements	Certification Requirements and Considerations
Class A			• For HEC and NHEC external cargo. (See Table 373-1) • Flight Manual Restrictions - § 133.47 requires a rotorcraft load combination flight manual supplement. Any flight envelope restrictions and emergency procedures from § 29.865 should be a part of this supplement. • The rotorcraft does not need Category A and OEI hover capability to carry HEC. • Load limit placards are required by § 29.865(c). • Flight envelope restriction placards may also be required for gross weight limitations, elimination of dangerous maneuvers, HEC requirements, etc. • Cargo tiedowns to prevent load shifting relative to airframe and for inflight load retention may be required. • Effect of external cargo carrier and its maximum cargo weight on load paths, loads and fatigue of existing structure should be determined. • Type Inspection Authorization (TIA) testing may be necessary to determine whether or not the system performs as intended and if placards and flight manual supplements are adequate. • The applicant should test the aerodynamic effect of several representative load shapes and include applicable information in the flight manual supplement. If such information is not in the RFM, then the operator may be required to obtain an operations approval under Part 133. • PCDS (i.e., the entire attached HEC carrying device) should be reviewed for relevant occupant safety criteria and placarding. • If all relevant criteria are met, non-jettisonable external tank loads (i.e., fluid or other loads can be certified as a Class A RLC [Reference d(22) and d(23)]. • To be certified under § 29.865 as a Class A RLC, the external load and its carrying device should have true payload capability (see definition) (i.e., it should be an external load, not an external fixture).
Fixed External Cargo Container - Is defined by § 1.1 as a load combination in which the external load cannot move freely, cannot be jettisoned, and does not extend below the landing gear. This category usually features multiple attachments (loadpaths) to the airframe. A typical example is a hard mounted cargo basket attached to the rotorcraft crosstubes which is used to carry external cargo from point A to point B. A non-typical example is a removable advertising sign that is in a folded configuration during take-off and landing, but is extended during flight. Maximum rotorcraft gross weight with external load may not exceed the maximum internal load gross weight approved under § 29.25(a).	Certification limit load is N_{ZW} X Maximum Substantiable External Load. N_{ZW} is 2.5 per § 29.865 (See Procedure, paragraph d(2)(ii)) for NHEC cargo. For HEC, $2.5 \leq N_{ZW} \leq 3.5$ depending on gross weight (see Procedure paragraph d(2)(iii)).	None. Cargo and its container are not jettisonable.	

Basic Definition and Intended Use	Typical Load Limits	Quick Release Requirements	Certification Requirements and Considerations
Class B			
Single or Multiple Point Suspension External Load Airborne Is defined by § 1.1 as a load combination in which the external load is jettisonable and is lifted free of land or water during the rotorcraft operation. The payload is typically suspended from a hook or a similar device. The hook may be attached to the rotorcraft structure, or it may be attached to a movable hoist cable with the hoist itself attached to the rotorcraft. A typical use is to lift a cargo load until it is completely airborne and fly it from point A to point B. The external hoist load may be stowed in the fuselage (in some cases) while being transported. The rotorcraft maximum gross weight with external load attached may exceed the maximum internal gross weight approved under § 29.25(a) as long as all weight above the maximum internal weight is jettisonable.	Certification limit load is N_{zw} X Maximum Substantiable External load. N_{zw} is 2.5 per § 29.865 (See Procedure, paragraph d(2)(ii) for NHEC). Load may be limited by winch/hoist allowables. For HEC, $2.5 \leq N_{zw} \leq 3.5$ depending on gross weight (see Procedure paragraph d(2)(iii)).	Yes - § 29.865(b)(1) requires that a primary quick release subsystem control device be installed on a primary control or in an equivalently accessible location. Also, a backup quick release system actuation device should be available and readily accessible.	• For HEC or NHEC external cargo (See Table 373-1). • Flight Manual Restrictions - § 133.47 requires a rotorcraft load combination flight manual supplement. Any flight envelope restrictions and emergency procedures from § 29.865 should be a part of this supplement. • The rotorcraft does not need Category A and OEI hover capability to carry HEC. • Load limit placards are required by § 29.865(c). • Flight envelope restriction placards may also be required for HEC. • Certifiable external cargo load capacity may be further limited by §§ 133.41 and 133.43. • Quick release subsystems and devices should be approved and be operable on a nonhazard basis by the pilot per § 29.865(b). • Quick release backup subsystems should be reliable but need not be overly sophisticated (cable cutters, axes, etc., used by crewmembers). • Effect of maximum suspended load and its attachment to rotorcraft structure on load paths, loads and fatigue of existing structure should be determined. • TIA testing may be necessary to determine whether or not the system performs as intended and if placards and flight manual supplements are adequate. • PCDS (i.e., the entire attached human external cargo carrying device) should be reviewed for relevant occupant safety criteria and placarding. • If all relevant criteria are met, jettisonable loads (i.e., fluid or other loads) can be certified as a Class B RLC [reference d(22) and d(23)].

Basic Definition and Intended Use	Typical Load Limits	Quick Release Requirements	Certification Requirements and Considerations
Class C			
Single or Multiple Point Suspension External Load Partially Airborne - Is defined by § 1.1 as an RLC in which the external load is jettisonable and remains in contact with land or water during the rotorcraft operation. The payload is typically partially suspended by a net or cables from a cargo hook or a similar device. The cargo hook may be attached to the rotorcraft structure or may be attached to a movable hoist cable and the hoist itself attached to the rotorcraft. A typical use is for stringing wire or laying cable where the payload is only partially suspended from the ground. (Note: Many applications combine both Category B and C operations because of the obvious utility involved.) The rotorcraft maximum gross weight with external load attached may exceed the maximum internal gross weight approved under § 29.25(a) as long as all weight above the maximum internal weight is jettisonable.	Certification limit load is N_{zw} X Maximum Substantiable External load. N_{zw} is 2.5 per § 29.865 (See Procedure, paragraph d(2)(ii) for NHEC). Load may be limited by hoist allowables. For HEC, $2.5 \leq N_{zw} \leq 3.5$ depending on gross weight (see Procedure paragraph d(2)(iii)).	Yes - § 29.865(b)(1) requires that a primary quick release subsystem control device be installed on a primary control or in an equivalently accessible location. Also, a backup quick release subsystem control device should be available and readily accessible.	• For HEC or NHEC external cargo (See Table 373-1). • Flight Manual Restrictions - § 133.47 requires a rotorcraft load combination flight manual supplement. Any flight envelope restrictions and emergency procedures from § 29.865 should be a part of this supplement. • The rotorcraft does not need Category A and OEI hover capability to carry HEC. • Load limit placards are required by § 29.865(c). • Flight envelope restriction placards may also be required for HEC. • Certifiable external cargo load capacity may be further limited by §§ 133.41 and 133.43. • Quick release subsystems and devices should be approved and be operable on a nonhazard basis by the pilot per § 29.865(b). • Quick release backup subsystems should be reliable, but need not be overly sophisticated (cable cutters, axes, etc., used by a crewmember). • Effect of the maximum suspended/attached load and its attachment to rotorcraft structure on load paths, loads and fatigue of existing structure should be determined. • TIA testing may be necessary to determine whether or not the system performs as intended and if placards and flight manual supplements are adequate. • PCDS (i.e., the entire attached HEC carrying device) should be reviewed for relevant occupant safety criteria and placarding.

Basic Definition and Intended Use	Typical Load Limits	Quick Release Requirements	Certification Requirements and Considerations
Class D			
Single or Multiple Point Suspension External Airborne Load. Is defined by § 1.1 as an RLC in which one or more persons who are passengers OTHER than crewmembers and/or persons who are essential to the external load operation are carried as an external load for compensation. Such passengers carried external to the rotorcraft in approved devices that meet the configuration definition of any other rotorcraft-load combination are defined as a Class D rotorcraft-load combination. This RLC is for HEC transport. The payload which typically consists of personnel and their PCDS can be configured in any safe manner. PCDS's may transport one or more persons. Typical PCDS's devices are vest and straps, baskets, life preservers with straps and attachment devices, cages, or a suspended container. (See Procedures d(13) and d(14). The maximum gross weight with external load attached should not exceed the OEI OGE Hover Performance capability for the operational ambient conditions (altitude and temperature).	For HEC, N_{zw} varies from 2.5 at max gross weight to 3.5 at minimum gross weight. (See Procedures d(2)(iii)). Load is usually limited by hoist allowable, attachment allowable or by PCDS allowable.	A PQRS control DAD (requiring two distinct actions) should be installed on a primary control or be in an equivalently accessible location such as near a designated primary crewmember's station. Also, a BQRS DAD should be available and readily accessible.	• Used only for HEC other than Class A, B, or C. Only an HEC load that consists of a person other than a crewmember or a person who is essential and directly connected with the external load operation may be carried as an approved Class D RLC. These persons are being carried (i.e., transported) externally (See Table 373-1). • This RLC combination cannot be used for NHEC (See Table 373-1). • Rotorcraft should meet the Transport Category A engine isolation requirements of Part 29 and should be certified for an OEI/OGE hover performance weight, altitude and temperature envelope that becomes the maximum envelope that can be used for Class D HEC operations. This is required for a Class D rating by § 133.45(e)(1). • PCDS's should be approved separately or as part of the certification project. • PCDS's should carry personnel internally or secure them safely in a harness or equivalent device. • Flight Manual Restrictions - § 133.47 requires a rotorcraft load combination flight manual supplement. Any flight envelope restrictions and emergency procedures from § 29.865 should be a part of this supplement. • Load limit placards are required by §29.865(c). • Flight envelope restriction placards may also be required. • Certifiable external load capacity is further limited by §§ 133.41, 133.43 and 133.45(e)(3), the load limit of the PCDS and its attachment to the rotorcraft. • QRS subsystem release devices should be approved and be operable on a nonhazard basis by the pilot or a designated primary crewmember per §§ 133.44(c)(6) and 29.865(b). • The PQRS should have an emergency release (DAD) requiring two distinct actions. • The BQRS subsystem should be accessible and reliable. • Rotorcraft should be equipped to allow direct intercom among all crewmembers (per § 133.45(e)(2)). • Effect of maximum external load and its attachment to rotorcraft structure on load paths, loads and fatigue (Re. AC 20-95) of existing structure should be determined. • TIA testing may be necessary to determine whether or not the system performs as intended and if placards and flight manual supplements are adequate.

Federal Register

Monday
July 13, 1998

Part VII

Department of Transportation

Federal Aviation Administration

14 CFR Parts 27 and 29

Rotorcraft Load Combination Safety Requirements; Proposed Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 27 and 29

[Docket No. 29277; Notice No.98–6]

RIN 2120–AG59

Rotorcraft Load Combination Safety Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed rulemaking.

SUMMARY: This document proposes the amendment of the airworthiness standards for rotorcraft load combination (RLC) certification. This proposal would revise the safety requirements for RLC's to address advances in technology and to provide an increased level of safety in the carriage of humans. These proposed amendments would provide an improvement in the safety standards for RLC certification and lead to a harmonized international standard.

DATES: Comments must be submitted on or before October 13, 1998.

ADDRESSES: Comments on this proposed rule may be delivered or mailed in triplicate to: Federal Aviation Administration (FAA), Office of the Chief Counsel, Attn: Rules Docket (AGC–200), Docket No. 29277, Room 915G, 800 Independence Avenue, SW., Washington, DC 20591. Comments delivered must be marked Docket No. 29277. Comments may also be sent electronically to the following internet address: 9-nprm-cmts@.faa.dot.gov. Comments may be examined in Room 915G on weekdays between 8:30 a.m. and 5:00 p.m., except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Mr. Mike Mathias, Rotorcraft Directorate, Aircraft Certification Service, Regulations Group, FAA, Fort Worth, Texas 76193–0111, telephone (817) 222–5123.

SUPPLEMENTARY INFORMATION:

Comments Invited

Interested persons are invited to submit written data, views, or arguments on this proposed rule. Comments relating to the environmental, energy, federalism, or economic impact that might result from adopting the proposals in this notice are also invited. Substantive comments should be accompanied by cost estimates. Comments should identify the regulatory docket number and should be submitted in triplicate to the Rules Docket address specified above.

All comments received on or before the closing date for comments specified will be considered by the Administrator before taking action on this proposed rulemaking. Late-filed comments will be considered to the extent practicable. The proposals contained in this notice may be changed in light of the comments received.

All comments received, as well as a report summarizing each substantive public contact with FAA personnel on this rulemaking, will be filed in the docket. The docket is available for public inspection before and after the comment closing date.

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. 29277.'' The postcard will be date stamped and returned to the commenter.

Availability of NPRM's

An electronic copy of this document may be downloaded using a modem and suitable communications software from the FAA regulations section of the Fedworld electronic bulletin board service (telephone: 703–321–3339), the Federal Register's electronic bulletin board service (telephone: 202–512–1661), or the FAA's Aviation Rulemaking Advisory Committee Bulletin Board service (telephone: 800–322–2722 or (202) 267–5948).

Internet users may reach the FAA's web page at http://www.faa.gov/avr/arm/nprm/nprm.htm or the Federal Register's web page at http://www.access.gpo.gov/su—docs/aces/aces140.html for access to recently published rulemaking documents.

Any person may obtain a copy of this NPRM by submitting a request to the FAA, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington DC 20591, or by calling (202) 267–9680. Communications must identify the notice number of this NPRM.

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

History

For many years the design standards for external load attaching means for normal and transport category rotorcraft were contained in Subpart D, Airworthiness Requirements of 14 CFR part 133 (part 133), Rotorcraft External Load Operations. However, these design standards more appropriately belonged under parts 27 and 29. Amendments 27–11 (41 FR 55469, December 20, 1976) and 29–12 (41 FR 55454, December 20, 1976) added new §§ 27.865 and 29.865 and moved some of these design standards from the operational rules of part 133 to the certification rules of parts 27 and 29.

Rotorcraft-load combination classes (RLC) are defined in 14 CFR 1.1. Part 133 prohibits the carrying of humans, except for crewmembers, external to the aircraft under all existing RLC's (A, B, or C). However, on April 5, 1978, Exemption No. 2534 was granted to permit carrying harbor pilots external to the rotorcraft using a hoist and sling.

Because of the proven public utility of the operations conducted with Exemption No. 2534, in January 1987, after notice and a public meeting, Amendment 133–9 (51 FR 40707, November 7, 1986) was adopted. Amendment 133–9 established provisions for a new Class D RLC for transporting external loads other than Classes A, B, or C. Class D may apply to either human or nonhuman external cargo operations; however, under Amendment 133–9, § 133.45(e) specifies that only certain Transport Category A rotorcraft can be used for RLC Class D external load operations. Also, Amendment 133–9 added § 133.35 to establish specific limitations and the necessary safety requirements for routine external load transportation under Class D.

Aviation Rulemaking Advisory Committee (ARAC) involvement

In 1991 the FAA requested that ARAC study the need to revise the regulations on RLC in light of advancements in technology and operational procedures and to develop regulatory recommendations. The ARAC was established on February 5, 1991 (56 FR 2190, January 22, 1991), to assist the FAA in the rulemaking process by providing advice from the private sector on major regulatory issues affecting aviation safety. The ARAC includes representatives of manufacturers, air carriers, general aviation, industry associations, labor groups, universities, and the general public. The ARAC's formation has given the FAA additional opportunities to solicit information directly from significantly affected parties who meet and exchange ideas about proposed and existing rules that should be either created, revised, or eliminated.

On November 27, 1992, following an announcement in the **Federal Register** (56 FR 63546, December 4, 1991), the ARAC charged The External Load

Working Group with making a recommendation to the ARAC concerning whether new or revised airworthiness standards are appropriate for Class D rotorcraft external loads, as follows: ''Should parts 27 or 29 be amended to incorporate Class D external load attaching means, to complement Amendment 133–9, which authorizes the transport of passengers external to the rotorcraft, with certain conditions and limitations?''

The working group, chaired by a representative from McDonnell Douglas Helicopter Systems, included technical specialists knowledgeable in both military and civil external load operations, in external load and emergency rescue equipment design and manufacturing, and in both FAA and industry external load design and operational requirements. This broad participation is consistent with FAA policy to have all known interested parties involved as early as practicable in the rulemaking process.

The working group reviewed unpublished data regarding external loads safety issues developed by the FAA as the starting point for their discussions. After reviewing the unpublished data, the working group determined that it was necessary to do further research and to include consideration of more diverse design configurations and operating procedures.

The working group reviewed current methods that the military and other nations' airworthiness authorities use to certificate aircraft conducting external load operations. The group also evaluated current operational practices with aircraft certificated in all categories and public aircraft operations involving human and nonhuman external loads. The working group researched available military and domestic safety standards and guidance, the accident and incident history of external load operations conducted under current certification standards, and the specific safety requirements necessary for human and nonhuman external load operations in each RLC class.

Technical Research

The following material was researched by the ARAC working group and contributed significantly to formulating these proposals. Copies may be found in Rules Docket No. 29277.

1. United States Army Material Command (USA, AMC) Pamphlet No. 706–203, ''Engineering Design Handbook Helicopter Engineering, Part Three, Qualification Assurance,'' Headquarters United States Army Material Command, Washington, D.C. 20315.

2. USAAVSCOM TR 89–D–22A, ''Aircraft Crash Survival Design Guide; Volume IV—Aircraft Seats, Restraints, Litters, and Cockpit/Cabin Delethalization.''

3. MIL–STD–882B, ''Military Standard-System Safety Program Requirements,'' March 30, 1984.

4. MIL–STD–1472D, ''Military Standard-Human Engineering Design Criteria for Military Systems, Equipment, and Facilities,'' March 14, 1989.

5. British Civil Airworthiness Requirements 29, Issue 1, December 17, 1986.

6. Advisory Circular 133–1A, ''Rotorcraft External-Load Operations in Accordance with part 133,'' October 16, 1979.

7. ''Rotorcraft Use in Disaster Relief and Mass Casualty Incidents-Case Studies,'' DOT/FAA/RD–90/10, June 1990.

8. ''Guidelines for Integrating Helicopter Assets into Emergency Planning,'' DOT/FAA/RD–90/11, July 1991.

9. FAA Order 8700.1, ''General Aviation Operations Inspector's Handbook'' Chapter 96, Change 8, March 1, 1992.

The research centered on the following:

(1) Current methods used by the military to qualify external loads;

(2) Current methods used by the world's airworthiness authorities for certification of external loads;

(3) Current practice in restricted category and public use operations regarding human and nonhuman external load operations;

(4) Load retention and release devices that exist and are certifiable;

(5) Current military and domestic safety standards and guidance;

(6) Accident and incident history of external load operations that relate to the current certification standards; and

(7) Specific certification safety requirements that are necessary for human versus nonhuman external load operations.

Statement of the Issues

Although rotorcraft external load operations are routinely conducted in a safe manner under the existing safety standards, several preventable accidents and incidents have occurred during the preceding decade. For example, several preventable inadvertent releases of humans being carried external to the rotorcraft have occurred due to the lack of specific safety standards for quick-release systems (QRS). Additionally, the equipment employed in external load operations has changed significantly since the existing safety standards were promulgated. Examples of these equipment changes are more diverse, maneuverable, and powerful rotorcraft designs, new QRS designs, new personnel carrying device systems (PCDS) designs, and new methods of rigging external loads to the rotorcraft.

Because of the need for both modernization and a higher level of safety, this proposal would address safety requirements for human external cargo (HEC) and nonhuman external cargo (NHEC); update load-to-vertical-angle certification requirements; add reliability and durability requirements for external load retention and release systems and devices; and add electromagnetic interference and lightning protection requirements because these items are not specifically addressed in the existing regulations.

In addition, this proposal would amend part 29 by adding new certification requirements that are compatible with the operating requirements of current part 133 for RLC Class D external loads. This proposal would provide a clearly specified certification safety standard for RLC Class D external loads in part 29. The change to part 29 would respond to increasing public demand for specific RLC Class D provisions that meet operational needs through standardized certification criteria.

Studies and analyses of service difficulty reports and the introduction of modern external load equipment and operational practices have shown a need for updating the regulations to (1) significantly decrease the potential for future accidents and incidents; (2) ensure that external cargo load carrying devices, their release mechanisms, their load carrying systems, and their flight performance, reflect modern operational needs; and (3) provide updated standards that can be harmonized with the Joint Airworthiness Regulations (JAR).

Current Requirements

Currently, §§ 27.865 and 29.865 contain identical provisions and apply only to RLC Class A, B, and C loads at the gross weights and associated load factors common for relatively heavy NHEC loads. Primary and secondary quick-release devices are required; however, specific safety features and test and reliability requirements for the entire QRS are not specified. In-flight handling qualities and release (i.e., jettisonability) characteristics of NHEC and HEC are not currently addressed.

Part 29 Transport Category A rotorcraft are eligible under part 133 for Class D RLC operations. However, part 29 design standards do not exist for certification of Class D RLC's.

FAA Evaluation of ARAC Recommendation

After reviewing the External Load Working Group's work product and the ARAC recommendations, the FAA has determined that parts 27 and 29 should be revised to establish an increased margin of safety in rotorcraft external load operations. These revisions are necessary to implement modern safety standards that accommodate current and anticipated operational RLC applications and procedures and provide separate levels of safety for NHEC and HEC RLC's. These new safety standards are more fully described in the General Discussion of Proposals section. These changes to parts 27 and 29 include the addition of: (1) increased load factors for HEC; (2) increased QRS safety standards for both NHEC and HEC; (3) new PCDS standards for HEC; (4) new flight-handling characteristic standards for both NHEC and HEC; (5) increased fatigue substantiation standards for both NHEC and HEC; and (6) to part 29 only, the RLC Class D standard. These improvements to the safety standards should prevent many accidents and incidents. The proposal would provide identical, improved external load standards for rotorcraft certificated under parts 27 and 29 and would provide RLC Class D certification standards under part 29.

General Discussion of Proposals

These proposals would provide essentially identical external load standards in parts 27 and 29. In addition, both the part 27 and 29 proposals would provide certification standards for all RLC's that are compatible with the operational requirements in part 133.

Proposed Amendments to §§ 27.25(c) and 29.25(c)

The proposed amendments to §§ 27.25 and 29.25 would limit the availability of increased gross weights to those RLC's that involve the carriage of nonhuman loads. For applications for certification with human loads, the applicant would be limited by subparagraph (c)(1) to the maximum weight established in § 27.25(a). The changes would be a new limitation to reflect the distinction being made between those operations involving the carrying of humans externally for which a higher level of safety is needed.

Proposed Amendments to §§ 27.865 and 29.865

Because the proposed amendments would address more than just the attachment means for external loads, the undesignated center headings and the section titles of proposed §§ 27.865 and 29.865 would be changed from ''External Load Attaching Means'' to ''External Loads.''

Proposed Amendments to §§ 27.865(a) and 29.865(a)

The addition of new human external cargo certification requirements (HEC) and additional requirements for nonhuman external cargo (NHEC) certification results in modification of §§ 27.865(a) and 29.865(a). The most significant modification is a change in the current load factor specification to distinguish between and provide the required additional level of safety for HEC.

Current §§ 27.865(a) and 29.865(a) require the use of a 2.5g vertical limit load factor or a lesser value (derived from current §§ 27.337 through 27.341 or 29.337 through 29.341) at the maximum external load value for which certification is requested. This 2.5g limit load factor would be retained for NHEC applications in the proposals.

However, for HEC applications that are typically lower gross weight configurations, proposed §§ 27.865(a) and 29.865(a) contain a higher vertical limit load factor to be applied to the external load attachment and the entire attached PCDS. The higher vertical limit load factor is specified by these proposals as either the analytically derived maximum vertical limit load factor for the proposed operating envelope or a vertical limit load factor of 3.5 (derived from §§ 27.337 and 29.337). However, in no case would these proposals allow the maximum vertical limit load factor for HEC to be less than 2.5. Linear interpolation between minimum and maximum vertical design load factors and standard operating gross weight is one simple, acceptable means to determine design limit load factors.

Proposed §§ 27.865(a) and 29.865(a) would also require the limit static load for any RLC, either HEC or NHEC, to be determined and applied in both the vertical direction, and for jettisonable external loads in any direction, making the maximum angle that can be achieved in service (but not less than 30°) with the vertical axis of the rotorcraft. The term ''maximum angle that can be achieved in service'' means the largest angle expected to occur during normal operation. This term is added to the vertical angle requirement to ensure that sidepull (or other) configurations used for jettisonable RLC applications, such as wire stringing, that typically involve angles greater than the current 30°, would be addressed at the time of certification. The current 30° angle requirement was established based on the rule-of-thumb design limit for winch or hoist applications typical when the rule was promulgated and applications using larger angles were unforeseen. The proposed rule would not change the 30° angle limitation for winch or hoist applications. The existing rule does not specifically address RLC applications such as sidepull configurations. These proposed section changes would more closely match the needed safety standards to the type of RLC operations in the industry.

Proposed Amendments to §§ 27.865(b) and 29.865(b)

The terms ''quick-release system,'' ''primary quick release subsystem,'' and ''backup quick release subsystem'' are substituted throughout proposed §§ 27.865(b) and 29.865(b) for the current terminology of quick-release device, primary quick-release device, and mechanical backup quick-release device to require certification of the entire QRS, not just the quick-release devices. The proposals would also require that the primary and backup QRS be isolated from one another to ensure fail safety.

Also to facilitate harmonization with the Joint Aviation Authorities (JAA), the FAA proposes to delete the current references to RLC Classes B and C from §§ 27.865(b) and 29.865(b). These references are not necessary to the proposed new §§ 27.865(b) and 29.865(b) because the design distinctions necessary to provide the required level of safety would be made during certification without a need to refer to the operations based RLC classes. These distinctions are made by specifying whether or not an external load is jettisonable or non-jettisonable and whether or not an external load is human or non-human.

Proposed Amendments to §§ 27.865(b)(1) and 29.865(b)(1)

Proposed §§ 27.865(b)(1) and 29.865(b)(1) would allow the primary quick release control to be mounted either on a primary control or in any equivalently accessible location. This proposed change is intended to liberalize design options and allow a more realistic workload distribution among larger dedicated crews while maintaining the same level-of-safety.

The proposals would allow the control to be operated by a crewmember without necessarily being reachable by the pilot. The rotorcraft's approved operating procedures must address the responsibilities and procedures for the control of the QRS.

Proposed Amendments to §§ 27.865(b)(2) and 29.865(b)(2)

Proposed §§ 27.865(b)(2) and 29.865(b)(2) would change the current requirement that the backup control for the quick-release device be only a manual mechanical control. These proposals would require that a backup quick release subsystem of an approved design be readily available to the pilot or other crewmember.

Proposed Amendments to §§ 27.865(b)(3)(i) and 29.865(b)(3)(i)

Because of adverse service history and the need to specifically distinguish the levels of safety for HEC and NHEC, proposed §§ 27.865(b)(3)(i) and 29.865(b)(3)(i) would require that both the primary and backup quick release subsystems be reliable, durable, and functional. Reliability would be demonstrated by use of design features and by use of failure modes and effects analysis. Both reliability and durability would be demonstrated by use of repetitive functional tests. These proposed reliability and durability criteria would apply only to newly modified or type certificated helicopters equipped with external load attachment provisions or devices or both.

Proposed Amendments to §§ 27.865(b)(3)(ii) and 29.865(b)(3)(ii)

Proposed §§ 27.865(b)(3)(ii) and 29.865(b)(3)(ii) would require protection of the quick-release subsystems against potential internal and external sources of electromagnetic interference (EMI) and lightning. The new requirements are necessary to prevent inadvertent jettison of NHEC and HEC from sources such as stray electromagnetic signals, static electricity, and lightning strikes. Proposed field intensity levels are 200 volts per meter for applicable portions of QRS used for HEC and 20 volts per meter for applicable portions of QRS used for NHEC. The purpose of the requirements is for those applicable portions of the QRS to withstand these field intensity levels without inadvertent load release.

Proposed Amendments to §§ 27.865(b)(3)(iii) and 29.865(b)(3)(iii)

Proposed §§ 27.865(b)(3)(iii) and 29.865(b)(3)(iii) would require that the quick-release subsystems be protected against failures that could occur as a result of an electrical or mechanical malfunction of other rotorcraft components.

Proposed Amendments to §§ 27.865(c) and 29.865(c).

This proposal would redesignate existing §§ 27.865(c) and 29.865(c) as §§ 27.865(e) and 29.865(e), respectively. New §§ 27.865(c) and 29.865(c) are proposed to separately address the safety requirements for HEC carriage. The new requirements would ensure that the HEC certification requirements are clearly and properly identified.

Proposed Amendments §§ 27.865(c)(1) and 29.865(c)(1)

Proposed §§ 27.865(c)(1) and 29.865(c)(1) would require that the HEC load release primary and backup controls meet the requirements of §§ 27.865(b) and 29.865(b), respectively, and that both controls be designed to require dual actuation (i.e., require two distinct actions) for load release. This is necessary to mitigate inadvertent HEC release.

Proposed Amendments to §§ 27.865(c)(2) and 29.865(c)(2)

Proposed §§ 27.865(c)(2) and 29.865(c)(2) would require that the applicant demonstrate that the PCDS is reliable in accordance with the HEC provisions of §§ 27.865(b)(3)(i) and 29.865(b)(3)(i), respectively; has the structural capability required under §§ 27.865(a) and 29.865(a), respectively; and has the essential personnel safety provisions (based on the design configuration of the PCDS) to minimize hazards to occupants carried external to the rotorcraft.

Proposed Amendments to §§ 27.865(c)(3) and 29.865(c)(3)

Proposed §§ 27.865(c)(3) and 29.865(c)(3) would require that all necessary placards and markings be provided and be properly located to facilitate their proper use and, for the PCDS, to clearly specify the ingress and egress instructions.

Proposed Amendments to §§ 27.865(c)(4) and 29.865(c)(4)

Proposed §§ 27.865(c)(4) and 29.865(c)(4) would require that an intercom system or other approved equipment be installed to ensure proper communication among crewmembers and occupants during an emergency. For simple rescue systems that do not have intercom systems mandated by operating regulations, voice signals or hand signals to PCDS occupants may be acceptable. In more complex systems, it is intended that more sophisticated communication systems, such as intercoms, be provided.

Proposed Amendments to §§ 27.865(c)(5) and 29.865(c)(5)

Proposed §§ 27.865(c)(5) and 29.865(c)(5) would require that all flight limitations and procedures for HEC operations be identified and incorporated in the flight manual.

Proposed Amendment to § 29.865(c)(6)

To be compatible with part 133.45(e), proposed § 29.865(c)(6) would require, for HEC operations that require the use of Category A rotorcraft only (Class D RLC), that one-engine-inoperative hover performance capability information based on a dynamic engine failure (simulated engine failure in an actual test rotorcraft) be provided in the flight manual for the operating weights, altitudes, and temperatures for which external load approval is requested.

Proposed Amendments §§ 27.865(d) and 29.865(d).

Proposed new §§ 27.865(d) and 29.865(d) would require that critically configured jettisonable external loads (class and type) must be shown to be both transportable and releasable without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions. Compliance with the proposed requirements can be accomplished by using a combination of analysis, ground tests, and flight tests. This is necessary to ensure that the extremities of the operating range are thoroughly explored without unnecessary risk and cost. The new provisions would mitigate HEC transport problems such as entanglements with the rotorcraft in flight and will provide a mandatory flight test validation of the QRS. Current §§ 27.865(d) and 29.865(d) would be revised and redesignated as §§ 27.865(f) and 29.865(f), respectively.

Proposed Amendments to §§ 27.865(e) and 29.865(e)

Current §§ 27.865(c) and 29.865(c) would be revised and redesignated as §§ 27.865(e) and 29.865(e), respectively. The proposals would amend these sections by adding a requirement to install a placard next to the external load attaching means that specifies any operational limitations in addition to the maximum authorized external load weight that can be attached.

Proposed Amendments to §§ 27.865(f) and 29.865(f)

Sections 27.865(d) and 29.865(d) would be revised and redesignated as §§ 27.865(f) and 29.865(f), respectively. These paragraphs would require that for NHEC, all critical structural elements such as those in the external load attachment and carrying system whose failure would result in a hazard to the rotorcraft (not just the cargo hook) have a fatigue analysis in accordance with §§ 27.571 and 29.571, as applicable. The proposals would also require that for HEC, the entire QRS and PCDS and their attachments to the rotorcraft have a fatigue analysis in accordance with §§ 27.571 or 29.571, as applicable.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. § 3507(d)), there are no requirements for information collection associated with this final rule.

International Compatibility

The FAA has reviewed corresponding International Civil Aviation Organization international standards and recommended practices and Joint Aviation Authorities regulations, where they exist, and has identified no differences in these proposed amendments and the foreign regulations.

Regulatory Evaluation Summary

Changes to federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation). In conducting these analyses, which are summarized as follows (and available in the docket), the FAA has determined that this NPRM is not a ''significant regulatory action'' under section 3(f) of Executive Order 12866 and therefore was not reviewed by the Office of Management and Budget. This NPRM is not considered significant under Department of Transportation's Policies and Procedures (44 FR 11034, February 26, 1979). In addition, for the reasons stated under the ''Trade Impact Statement'' and the ''Regulatory Flexibility Determination,'' the FAA certifies that this NPRM will not have a significant economic impact on a substantial number of small entities and would not result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually.

The FAA invites the public to provide comments (and related data) on the assumptions made in this evaluation. All comments received will be considered in the final regulatory evaluation.

Costs and Benefits

Costs

The costs of the proposed rule, which would be borne by manufacturers and operators, are evaluated for the time period extending from its implementation date through the operating lives of 75 rotorcraft assumed to be produced under four new type certificates (involving 15-year production runs of 5 rotorcraft per year total under all four new type certificates) and placed into part 133 service. Over the course of this evaluation period, incremental costs would total approximately $388,500 (1996 dollars), or $203,000 discounted to present value (using an interest rate of seven percent and letting ''present'' be the date of initial type certification application). Of the $388,500 total cost, $156,000 is attributable to incremental design, analysis, test, and other certification costs, $30,000 to incremental production costs (75 rotorcraft at $400 each), and $202,500 to incremental weight penalty fuel costs ($180 per year per rotorcraft over 15-year operating lives of 75 rotorcraft). On a per-rotorcraft basis, costs would average approximately $5,200, or $2,700 discounted. These incremental costs would be offset to some extent by potential cost savings associated with the harmonization of these proposals with the JAA and eventual creation of identical JAA airworthiness standards, streamlining of certification approvals for part 133 operators, and some relaxed requirements for parts 27 and 29 manufacturers (see Benefits section, below).

Benefits

To estimate the safety benefits of the proposed rule, the FAA reviewed records of accidents involving part 133 operators that occurred between mid-1983 and mid-1994 that could have been prevented or the losses reduced if the proposed changes were in effect. During the 11-year period, there were 17 such accidents involving fatal and/or non-fatal injuries, or damage to equipment, or both. Eight of the accidents resulted in harm to persons (either inside or outside of the rotorcraft), totaling eight fatalities and two serious injuries. Fifteen of the 17 accidents involved either substantial damage (seven) or destruction of the rotorcraft (eight).

To provide a basis for comparing the safety benefits and costs of rulemaking actions, the FAA currently uses a minimum statistical value of $2.7 million for a fatality avoided and $518,000 for a serious injury avoided. Applying these standards to the casualty losses summarized above and making allowances for the costs of rotorcraft damage, the total cost of the 17 accidents was approximately $27.2 million.

The FAA estimates that the proposed rule could prevent at least 50 percent of the type of accidents summarized above. Applying it retrospectively would yield dollar benefits of approximately $13.6 million (one-half of $27.2 million). Over the 11-year accident evaluation period, the part 133 fleet averaged approximately 300 active rotorcraft. Therefore, the benefits would average approximately $4,100 per year per rotorcraft ($13.6 million/11 years/300 operating part 133 rotorcraft per year). Applying this per-rotorcraft safety benefit to the cumulative number of complying rotorcraft results in total safety benefits of $4.6 million (or $1.3 million discounted to present value). On a per-rotorcraft basis, these benefits would average approximately $61,500, or $17,300 discounted.

In addition to improving safety, the proposed rule would provide some cost-relief in certain respects. New production rotorcraft would be delivered with standardized procedures for external load operations, and could result in a small savings to part 133 operators. Further, changes to current regulations that relate to the primary and backup quick-release devices would reduce production costs for parts 27 and 29 rotorcraft manufacturers. The changes would also increase harmonization and commonality between U.S. and European airworthiness standards. Harmonization would eliminate unnecessary differences in airworthiness requirements, thus reducing manufacturers' certification costs.

Comparison of Costs and Benefits

The proposed rule would generate benefits in the form of increased safety and cost relief (see preceding paragraph—the potential cost relief has not been included in the cost/benefit calculation). On a per-rotorcraft basis, the life-cycle safety benefits would average approximately $17,300 (discounted) and the costs would average approximately $2,700 (discounted), yielding a benefit-to-cost ratio of 6.4 to 1. On this basis alone, the proposed rule is cost-beneficial; additional quantified efficiency and harmonization benefits would increase this ratio.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation.'' To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 act provides that the head of the agency may so certify and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The entities that would be affected by the proposed rule consist of rotorcraft manufacturers (included in Standard Industrial Classification (SIC 3721, Aircraft and Aircraft Parts Manufacturers) and external load operators (SIC 4512, 4513, 4522). Manufacturers would incur additional development, certification, and production costs. In addition to indirectly incurring all or part of these costs in the form of higher rotorcraft acquisition costs, operators would incur increased fuel costs resulting from weight penalties. Although the certification costs (non-recurring) would be either fully absorbed by the manufacturer(s), passed on in-total to operator(s) (purchasers), or more likely, absorbed in some proportion by both, the FAA in this analysis adopts a conservative approach and allocates total certification costs to each category in assessing significant economic impact. Incremental per-unit production costs, however, are assumed to be fully passed on to purchasers (operators).

For manufacturers, a small entity is one with 1,500 or fewer employees. Only five rotorcraft manufacturers have 1,500 or fewer employees and therefore qualify as small entities. However, three of these are not currently producing new type-certificated rotorcraft, and a fourth does not produce rotorcraft used for external loads. The fifth small manufacturer produces specialized smaller rotorcraft, a minority of which are configured for external load operations; this producer does not compete with the larger manufacturers. Annualized certification costs imposed by the proposed rule are estimated to be $3,800 per manufacturer for each certification and is not considered significant within the meaning of the RFA.

There are numerous external load operators. The FAA has not determined how many of these are small operators and if a substantial number would potentially be impacted by the proposal. However, most external load operations involve specialized activities such as logging, offshore oil drilling, or emergency rescue operations, the demand for which is highly price-inelastic; the operators can readily pass on the incremental costs to their customers. Notwithstanding, the maximum annualized cost per rotorcraft would most likely not be greater than $314 (includes manufacturers' certification and production costs passed on to the purchaser and increased fuel costs, but excludes potential offsetting cost-savings). This amount probably equates to less than the cost of two hours' operating time (representing a de minimus portion of annual revenues) and is not considered significant within the meaning of the RFA. In addition, no small manufacturer or small operator would bear a disproportionate cost burden nor have a greater likelihood of failing in business compared to larger entities.

Based on the findings delineated above and consistent with the objectives and requirements of the RFA as amended, the FAA certifies that this proposed rule would not have a significant economic impact on a substantial number of small entities. The FAA invites comments on this finding (and the underlying assumptions) during the public comment period following publication of the subject NPRM.

International Trade Impact Assessment

Consistent with the Administration's belief in the general superiority, desirability, and efficacy of free trade, it is the policy of the Administrator to remove or diminish, to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and those affecting the import of foreign goods and services into the United States.

In accordance with that policy, the FAA is committed to develop as much as possible its aviation standards and practices in harmony with its trading partners. Significant cost savings can result from this, both to United States' companies doing business in foreign markets, and foreign companies doing business in the United States.

This proposed rule is a direct action to respond to this policy by increasing the harmonization of the U.S. Federal Aviation Regulations with the European Joint Aviation Requirements. The result would be a positive step toward removing impediments to international trade.

Federalism Implications

The regulations proposed herein will 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.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Pub. L. 104–4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected

officers (or their designees) of State, local, and tribal governments on a proposed ''significant intergovernmental mandate.'' A ''significant intergovernmental mandate'' under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

The FAA determines that this proposed rule does not contain a significant intergovernmental or private sector mandate as defined by the Act.

List of Subjects

14 CFR Part 27

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

14 CFR Part 29

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

The Proposed Amendments

In consideration of the foregoing, the Federal Aviation Administration proposes to amend parts 27 and 29 of Title 14, Code of Federal Regulations (14 CFR parts 27 and 29) as follows:

PART 27—AIRWORTHINESS STANDARDS: NORMAL CATEGORY ROTORCRAFT

1. The authority citation for part 27 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

2. Section 27.25 is amended by revising paragraph (c) to read as follows:

§ 27.25 Weight limits

* * * * *

(c) *Total weight with jettisonable external load.* A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established under paragraph (a) of this section may be established for any rotorcraft-load combination if—

(1) The rotorcraft-load combination does not include human external cargo,

(2) Structural component approval for external load operations under either § 27.865, or under equivalent operational standards is obtained,

(3) The portion of the total weight that is greater than the maximum weight established under paragraph (a) of this section is made up only of the weight of all or part of the jettisonable external load,

(4) Structural components of the rotorcraft are shown to comply with the applicable structural requirements of this part under the increased loads and stresses caused by the weight increase over that established under paragraph (a) of this section, and

(5) Operation of the rotorcraft at a total weight greater than the maximum certificated weight established under paragraph (a) of this section is limited by appropriate operating limitations under § 27.865 (a) and (d) of this part.

3. The undesignated center heading preceding § 27.865 is revised as set forth below, and in § 27.865 the section heading, paragraph (a) introductory text and paragraph (b) are revised; paragraphs (c) and (d) are redesignated as paragraphs (e) and (f) and revised; and new paragraphs (c) and (d) are added to read as follows:

External Loads

§ 27.865 External loads.

(a) It must be shown by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for nonhuman external cargo applications can withstand a limit static load equal to 2.5, or some lower load factor approved under §§ 27.337 through 27.341, multiplied by the maximum external load for which authorization is requested. It must be shown by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under §§ 27.337 through 27.341, multiplied by the maximum external load for which authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, must be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load must also be applied in any direction making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if—

* * * * *

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, must include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system must consist of a primary quick release subsystem and a backup quick release subsystem that are isolated from one another. The quick-release system, and the means by which it is controlled, must comply with the following:

(1) A control for the primary quick release subsystem must be installed either on one of the pilot's primary controls or in an equivalently accessible location and must be designed and located so that it may be operated by either the pilot or a crewmember without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(2) A control for the backup quick release subsystem, readily accessible to either the pilot or another crewmember, must be provided.

(3) Both the primary and backup quick release subsystems must—

(i) Be reliable, durable, and function properly with all external loads up to and including the maximum external load for which authorization is requested.

(ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release.

(A) The minimum level of protection required for jettisonable rotorcraft-load combinations used for nonhuman external cargo is a radio frequency field strength of 20 volts per meter.

(B) The minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per meter.

(iii) Be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft must—

(1) For jettisonable external loads, have a quick-release system that meets the requirements of paragraph (b) of this section and that—

(i) Provides a dual actuation device for the primary quick release subsystem, and

(ii) Provides a separate dual actuation device for the backup quick release subsystem.

(2) Have a reliable, approved personnel carrying device system that has the structural capability and

personnel safety features essential for external occupant safety,

(3) Have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, the ingress and egress instructions.

(4) Have equipment to allow direct intercommunication among required crewmembers and external occupants, and

(5) Have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations.

(d) The critically configured jettisonable external loads must be shown by a combination of analysis, ground tests, and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under § 27.25 and this section.

(f) The fatigue evaluation of § 27.571 of this part does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of § 27.571 of this part applies to the entire quick release and personnel carrying device structural systems and their attachments.

PART 29—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

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

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

§ 29.25 [Amended]

5. Section 29.25 is amended by revising paragraph (c) to read as follows:

* * * * *

(c) *Total weight with jettisonable external load.* A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established under paragraph (a) of this section may be established for any rotorcraft-load combination if—

(1) The rotorcraft-load combination does not include human external cargo,

(2) Structural component approval for external load operations under either § 29.865 or under equivalent operational standards is obtained,

(3) The portion of the total weight that is greater than the maximum weight established under paragraph (a) of this section is made up only of the weight of all or part of the jettisonable external load,

(4) Structural components of the rotorcraft are shown to comply with the applicable structural requirements of this part under the increased loads and stresses caused by the weight increase over that established under paragraph (a) of this section, and

(5) Operation of the rotorcraft at a total weight greater than the maximum certificated weight established under paragraph (a) of this section is limited by appropriate operating limitations under § 29.865 (a) and (d) of this part.

6. The undesignated center heading preceding § 29.865 is revised as set forth below, and in § 29.865 the section heading, paragraph (a) introductory text and paragraph (b) are revised; paragraphs (c) and (d) are redesignated as paragraphs (e) and (f) and revised; and new paragraphs (c) and (d) are added to read as follows:

External Loads

§ 29.865 External loads.

(a) It must be shown by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for nonhuman external cargo applications can withstand a limit static load equal to 2.5, or some lower load factor approved under §§ 29.337 through 29.341, multiplied by the maximum external load for which authorization is requested. It must be shown by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under §§ 29.337 through 29.341, multiplied by the maximum external load for which authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, must be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load must also be applied in any direction making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if—

* * * * *

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, must include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system must consist of a primary quick release subsystem and a backup quick release subsystem that are isolated from one another. The quick release system, and the means by which it is controlled, must comply with the following:

(1) A control for the primary quick release subsystem must be installed either on one of the pilot's primary controls or in an equivalently accessible location and must be designed and located so that it may be operated by either the pilot or a crewmember without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(2) A control for the backup quick release subsystem, readily accessible to either the pilot or another crewmember, must be provided.

(3) Both the primary and backup quick release subsystems must—

(i) Be reliable, durable, and function properly with all external loads up to and including the maximum external load for which authorization is requested.

(ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release.

(A) The minimum level of protection required for jettisonable rotorcraft-load combinations used for nonhuman external cargo is a radio frequency field strength of 20 volts per meter.

(B) The minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per meter.

(iii) Be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft must—

(1) For jettisonable external loads, have a quick-release system that meets the requirements of paragraph (b) of this section and that—

(i) Provides a dual actuation device for the primary quick release subsystem, and

(ii) Provides a separate dual actuation device for the backup quick release subsystem.

(2) Have a reliable, approved personnel carrying device system that has the structural capability and personnel safety features essential for external occupant safety.

(3) Have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, ingress and egress instructions,

(4) Have equipment to allow direct intercommunication among required crewmembers and external occupants,

(5) Have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations, and

(6) For human external cargo applications requiring use of Category A rotorcraft, have one-engine-inoperative hover performance data and procedures in the flight manual for the weights, altitudes, and temperatures for which external load approval is requested.

(d) The critically configured jettisonable external loads must be shown by a combination of analysis, ground tests, and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under § 29.25 and this section.

(f) The fatigue evaluation of § 29.571 of this part does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of § 29.571 of this part applies to the entire quick release and personnel carrying device structural systems and their attachments.

Issued in Washington, DC, on July 6, 1998.

Thomas E. McSweeney,

Director, Aircraft Certification Service.

[FR Doc. 98–18552 Filed 7–10–98; 8:45 am]

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Part II

Department of Transportation

Federal Aviation Administration

14 CFR Parts 27 and 29
Rotorcraft Load Combination Safety Requirements; Final Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 27 and 29

[Docket No. 29277; Amendment No. 27-36 and 29-43]

RIN 2120-AG59

Rotorcraft Load Combination Safety Requirements

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: This final rule amends the airworthiness standards to provide improved safety standards for rotorcraft load combination (RLC) certification. Several accidents occurred in the past 15 years involving the carriage of humans external to the rotorcraft. These amendments provide an increased level of safety in the carriage of humans. Also, significant changes in equipment employed in external load operations have occurred. This document addresses those advances in technology and is harmonized to international standards.

EFFECTIVE DATE: October 5, 1999.

FOR FURTHER INFORMATION CONTACT: Mike Mathias, Rotorcraft Directorate, Aircraft Certification Service, Regulations Group, FAA, Fort Worth, Texas 76193-0111, telephone (817) 222-5123, fax 817-222-5959.

SUPPLEMENTARY INFORMATION:

Availability of Final Rules

Using a modern and suitable communications software, an electronic copy of this document may be downloaded from the FAA regulations section of the Fedworld electronic bulletin board service (telephone: 703-321-3339), or the Government Printing Office's (GPO) electronic bulletin board service (telephone: 202-512-1661).

Internet users may reach the FAA's web page at http://www.faa.gov/avr/arm/nprm/nprm.htm or the GPO's web page at http://www.access/gpo.gov/nara for access to recently published rulemaking documents.

Any person may obtain a copy of this final rule by submitting a request to the FAA, Office of Rulemaking, ARM-1, 800 Independence Avenue, SW, Washington DC 20591, or by calling (202) 267-9680. Communications must identify the amendment number or docket number of this final rule.

Persons interested in being placed on a mailing list for future Notices of Proposed Rulemaking (NPRM's) and final rules should request from ARM-1 a copy of Advisory Circular (AC) No. 11-2A, Notice of Proposed Rulemaking Distribution System, which describes the application procedures.

Small Entity Inquiries

If you are a small entity and have a question, contact your local FAA official. If you do not know how to contact your local FAA official, you may contact Charlene Brown, Program Analyst Staff, Office of Rulemaking, ARM-27, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, 1-888-551-1594. Internet users can find additional information on SBREFA in the "Quick Jump" section of the FAA's web page under "Rulemaking (ARM)" at http://www.faa.gov and may send electronic inquiries to the following Internet address: 9-AWA-SBREF@faa.gov.

Background

On November 27, 1991, following an announcement in the **Federal Register** (56 FR 63546, December 4, 1991), the ARAC charged the External Load Working Group to recommend new or revised airworthiness standards for Class D rotorcraft external loads. The Working Group assigned to this task included technical specialists knowledgeable in all areas of external load design and operational requirements. This broad participation is consistent with FAA policy to involve all known interested parties early in the rulemaking process.

The working group researched a wide range of data developed by the FAA, the military, and other nations' airworthiness authorities. Copies of the research documents are included in the docket.

Although rotorcraft external load operations are routinely conducted in a safe manner, several preventable accidents and incidents have occurred during the preceding 15 years. For example, several preventable inadvertent releases of humans carried external to the rotorcraft have occurred. Also, significant changes in the equipment employed in external load operations have occurred such as new rigging devices. Rotorcraft are now more diverse in design, more maneuverable, and more powerful.

A study of the issues prompted the Working Group to recommend updated requirements for modern external load equipment and operational practices. The working group proposed requirements to (1) decrease the potential for future accidents and incidents; (2) provide that external cargo load carrying devices, their release mechanisms, their load carrying systems, and their flight performance reflect modern operational needs; (3) provide separate and increased levels of safety for nonhuman external cargo (NHEC) and human external cargo (HEC) RLC's; and (4) provide updated standards that harmonize with the Joint Airworthiness Regulations (JAR).

The FAA evaluated the ARAC recommendations and proposed external load standards for rotorcraft certificated under 14 CFR parts 27 and 29 in NPRM 98-6 published on July 13, 1998 (63 FR 37745). The FAA received comments from four commenters. All commenters were generally in favor of the proposals but offered the following comments:

Discussion of Comments

14 CFR 27.865(b) and 29.865(b)

A commenter recommended that §§ 27.865(b), 29.865(b), 27.865(b)(3)(ii), and 29.865(b)(3)(ii) be expanded to better define the lightning requirements for external loads. The commenter further recommended that operational limitations be required, particularly when environmental forecasts involve lightning. The FAA believes that the commenter's concerns are fully and adequately addressed by the current certification regulations and these proposals. The level of protection from lightning provided by the current certification regulations, §§ 27.610 and 29.610, and proposals §§ 27.865(b)(3)(ii) and 29.610(b)(3)(ii), clearly defines a reasonable level of safety for the entire RLC from random lightning strikes during operations. Any specific operational restriction for a given RLC that clearly relates to potential lightning strikes will become a flight manual limitation under current §§ 27.1583, 29.1583, and 133.45.

Another commenter states that the wording in proposed §§ 27.865(b)(3)(i) and 29.865(b)(3)(i) implies that the quick release system (QRS) must only be capable of releasing the rated load at 1G. The commenter recommended an improvement to the wording to require that the QRS be certified to the full limit load capability. The FAA intends that the QRS must function up to the applicable limit load defined by the vertical limit load factors and their application proposed in §§ 27.865(a) and 29.865(a). The proposal in §§ 27.865(b)(3)(i) and 29.865(b)(3)(i) is identical to current §§ 27.865(b)(3) and 29.865(b)(3). The wording is commonly understood and is defined in current advisory material as the maximum external limit load. However, the FAA agrees that the wording could be

improved and will insert the word "limit" in §§ 27.865(b0(3)(i) and 29.865(b)(3)(i).

14 CFR 27.865(c) and 29.865(c)

A commenter stated that § 29.865(c)(5) would require special procedures and abnormal piloting techniques and should be removed. The FAA disagrees. Special procedures are not required for any external load operation involving human external cargo. The only procedures necessary for external load operations (current or proposed) are those now required under current regulations such as §§ 29.1585 and 133.45. No abnormal piloting techniques are intended or foreseen.

A commenter stated that the requirement for performance information in the proposed § 29.865(c)(6) would be better placed in § 29.1587, *Performance information.* The FAA disagrees. Placing the performance criteria as proposed by the commenter was considered during formulation of the proposals and rejected. Specific external loads performance criteria is most readily available and useful in §§ 27.865(c)(6) and 29.865(c)(6). The FAA considers the proposed placement best for clarity, efficiency, and commonality with 14 CFR part 133 (part 133).

Two commenters recommended creating a new § 27.865(c)(6). The first commenter noted that part 27 has recently been amended (Amendment 27–33) to add a Category A performance provision and recommended that § 27.865(c)(6) be added to part 27. The second commenter recommended revising § 29.865(c)(6) to include multi-engine rotorcraft having Category A engine isolation design features and adding an identical § 27.865(c)(6) requirement. The second commenter also recommended that § 133.45(e)(1) be revised to include Class D operations with multi-engine part 27 rotorcraft having Category A engine isolation design features. The FAA agrees in principle that a multi-engine part 27 Category A rotorcraft could provide an adequate level of performance that would permit a safe Class D operation; however, changing § 133.45(e)(1) to permit this is beyond the scope of the proposals. The FAA will consider these changes for future rulemaking.

14 CFR 27.865(d) and 29.865(d)

One commenter was concerned that the proposed wording of §§ 27.865(d) and 29.865(d) would mandate flight testing of each critical configuration and airspeed for each proposed external load. The FAA did not intend such a requirement. When deemed sufficient, analysis alone or analysis supported by bench tests may be used for a given critical configuration and airspeed without the necessity for flight tests.

General Comments

A commenter stated that a number of the proposed requirements could benefit from an indication of what an "acceptable means of compliance" would be. The commenter recommended that AC 25.1309–1A be revised to include these elements. The FAA disagrees. Advisory Circular (AC) 25.1309–1A contains advisory material for part 25 airplanes. The AC's for parts 27 and 29 contain an acceptable means of compliance for rotorcraft.

The FAA adopts the proposals as proposed in NPRM 98–6 except for adding the word "limit" to §§ 27.865(b)(3(i) and 29.865(b)(3)(i) as previously discussed.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), there are no requirements for information collection associated with this final rule.

International Compatibility

The FAA has reviewed corresponding International Civil Aviation Organization international standards and recommended practices and JAA regulations, where they exist, and has identified or discussed similarities and differences in these amendments and foreign regulations.

Regulatory Evaluation Summary

Changes to federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation). In conducting these analyses, which are summarized below (and available in the docket), the FAA has determined that this final rule will generate benefits exceeding its costs and is not "a significant regulatory action" as defined in Executive Order 12866 and the Department of Transportation's Regulatory Policies and Procedures. In addition, this final rule will not have a significant impact on a substantial number of small entities, will not constitute a barrier to international trade, and will not result in the expenditure by State, local or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually.

The FAA invited the public to provide comments (and related data) on the assumptions made in the regulatory evaluation for the NPRM. No comments were received on the preliminary regulatory evaluation.

Costs and Benefits

Costs

The costs of the rule, which will be borne by manufacturers and operators, are evaluated for the time period extending from its implementation date through the operating lives of 75 rotorcraft assumed to be produced under 4 new type certificates (involving 15-year production runs of 5 rotorcraft per year total under all 4 new type certificates) and placed into part 133 service. Over the course of this evaluation period, incremental costs will total approximately $679,000 (1998 dollars) or $449,000 discounted to present value (using an interest rate of 7 percent and letting "present" be the date of initial type certification application). Of the $679,000 total cost, $447,000 is attributable to incremental design, analysis, test, and other certification costs, $30,000 to incremental production costs (75 rotorcraft at $400 each), and $202,500 to incremental weight penalty fuel costs ($180 per year per rotorcraft over 15-year operating lives of 75 rotorcraft). On a per-rotorcraft basis, costs will average approximately $9,000 or $6,000 discounted. These incremental costs will be offset to some extent by potential cost savings associated with harmonizing these airworthiness standards with the JAA, streamlining certification approvals for part 133 operators, and relaxing some of the requirements for parts 27 and 29 manufacturers (see Benefits section, below).

Benefits

To estimate the safety benefits of the rule, the FAA reviewed records of accidents involving part 133 operators that occurred between mid-1983 and

1998 that could have been prevented or the losses reduced if the changes in the rule had been in effect. During this 15-year period, there were 22 such accidents involving fatal and/or non-fatal injuries or damage to equipment or both. Ten of the accidents resulted in harm to persons (either inside or outside of the rotorcraft), totaling nine fatalities and two serious injuries. Twenty of the 22 accidents involved either substantial damage (8) or destruction of the rotorcraft (12).

To provide a basis for comparing the safety benefits and costs of rulemaking actions, the FAA currently uses a minimum statistical value of $2.7 million for fatality avoided and $521,800 for a serious injury avoided. Applying these standards to the casualty losses summarized above and making allowances for the costs of rotorcraft damage, the total cost of the 22 accidents was approximately $31.1 million.

The FAA estimates that the final rule could prevent at least 50 percent of the type of accidents summarized above. Applying it retrospectively yields dollar benefits of approximately $15.5 million (One-half of $31.1 million). Over the 15-year accident evaluation period, the part 133 fleet averaged approximately 300 active rotorcraft. Therefore, the benefits averaged approximately $3,400 per year per rotorcraft ($15.5 million/15years/300 operating part 133 rotorcraft per year). Applying this per-rotorcraft safety benefit to the cumulative number of complying rotorcraft results in total safety benefits of $3.8 million (or $1.1 million discounted to present value). On a per-rotorcraft basis, these benefits average approximately $51,000 or $14,300 discounted to the present.

In addition to improving safety, the final rule provides some cost-relief in certain respects. New production rotorcraft will be delivered with standardized procedures for external load operations, and these procedures could result in a small savings to part 133 operators. Further, changes to the preceding regulations that relate to the primary and backup quick-release devices will reduce production costs for parts 27 and 29 rotorcraft manufacturers. The changes will also increase harmonization and commonality between U.S. and European airworthiness standards. Harmonization will eliminate unnecessary differences in airworthiness requirements, thus reducing manufacturers' certification costs.

Comparison of Costs and Benefits

The rule will generate benefits in the form of increased safety and cost relief (see preceding paragraph—the potential production cost relief has not been included in the cost/benefit calculation). On a per-rotorcraft basis, the life-cycle safety benefits will average approximately $14,300 (discounted) and the costs will average approximately $6,000 (discounted), yielding a benefit-to-cost ratio of 2.4 to 1. On this basis alone, the rule is cost-beneficial; additional quantified efficiency and harmonization benefits will increase this ratio.

Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 establishes "as a principle of regulatory issuance that agencies shall endeavor, consistent with the objective of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the business, organizations, and governmental jurisdictions subject to regulation." To achieve that principle, the Act requires agencies to solicit and consider flexible regulatory proposals and to explain the rationale for their actions. The Act covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a proposed or final rule will have a significant economic impact on a substantial number of small entities. If the determination is that it will, the agency must prepare a regulatory flexibility analysis (RFA) as described in the Act.

However, if an agency determines that a proposed or final rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the 1980 Act provides that the head of the agency may so certify and an RFA is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

The entities that will be affected by this rule consist of rotorcraft manufacturers (included in Standard Industrial Classification (SIC) 3721, Aircraft and Aircraft Parts Manufacturers) and external load operators (SIC 4512, 3413, 4522). Manufacturers will incur additional development, certification, and production costs. In addition to indirectly incurring all or part of these costs in the form of higher rotorcraft acquisition costs, operators will incur increased fuel costs resulting from weight penalties. Although the certification costs (non-recurring) will be either fully absorbed by the manufacturer(s), passed on in-total to operator(s) (purchasers), or more likely, absorbed in some proportion by both, the FAA in this analysis adopts a conservative approach and allocates total certification costs to each category in assessing significant economic impact. Incremental per-unit production costs, however, are assumed to be fully passed on to purchasers (operators.)

For manufacturers, a small entity is one with 1,500 or fewer employees. Only 5 rotorcraft manufacturers have 1,500 or fewer employees and therefore qualify as small entities. However, three of these are not currently producing new type-certificated rotorcraft, and a fourth does not produce rotorcraft used for external loads. The fifth small manufacturer produces specialized smaller rotorcraft, a minority of which are configured for external load operations. This producer does not compete with the larger manufacturers. The annualized certification costs imposed by the rule are estimated to be $10,800 per manufacturer for each certification and are not considered significant within the meaning of the RFA.

There are numerous external load operators. The FAA has not determined how many of these are small operators and if a substantial number will potentially be impacted by the rule. However, most external load operations involve specialized activities such as logging, offshore oil drilling, or emergency rescue operations. The demand for such operations is highly price-inelastic; the operators can readily pass on the incremental costs to their customers. Notwithstanding, the maximum annualized cost per rotorcraft will most likely not be greater than $618 (discounted) (includes manufacturers' certification and production costs passed on to the purchaser and increased fuel costs but excludes potential offsetting cost-savings). This amount probably equates to less than the cost of 4 hours' operating time (representing a de minimus portion of annual revenues) and is not considered significant within the meaning of the Act. In addition, no small manufacturer or small operator will bear a disproportionate cost burden nor have a greater likelihood of failing in business compared to larger entities.

Based on the findings delineated above and consistent with the objectives and requirements of the RFA as amended, the FAA certifies that this final rule will not have a significant

economic impact on a substantial number of small entities.

International Trade Impact Assessment

Consistent with the Administration's belief in the general superiority, desirability, and efficacy of free trade, it is the policy of the Administrator to remove or diminish, to the extent feasible, barriers to international trade, including both barriers affecting the export of American goods and services to foreign countries and those affecting the import of foreign goods and services into the United States.

In accordance with that policy, the FAA is committed to develop as much as possible its aviation standards and practices in harmony with its trading partners. Significant cost savings can result from this, both to United States' companies doing business in foreign markets, and foreign companies doing business in the United States. This final rule is a direct action to respond to this policy by increasing the harmonization of the U.S. Federal Aviation Regulations with the European JAR. The result will be a positive step toward removing impediments to international trade.

Federalism Implications

The regulations herein will not have a substantial direct effect 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 rule will not have sufficient federalism implications to warrant the preparation of a federalism assessment.

Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (the Act), enacted as Pub. L. 104–4 on March 22, 1995, requires each Federal agency, to the extent permitted by law, to prepare a written assessment of the effects of any Federal mandate in a proposed or final agency rule that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more (adjusted annually for inflation) in any one year. Section 204(a) of the Act, 2 U.S.C. 1534(a), requires the Federal agency to develop an effective process to permit timely input by elected officers (or their designees) of State, local, and tribal governments on a proposed "significant intergovernmental mandate." A "significant intergovernmental mandate" under the Act is any provision in a Federal agency regulation that will impose an enforceable duty upon State, local, and tribal governments, in the aggregate, of $100 million (adjusted annually for inflation) in any one year. Section 203 of the Act, 2 U.S.C. 1533, which supplements section 204(a), provides that before establishing any regulatory requirements that might significantly or uniquely affect small governments, the agency shall have developed a plan that, among other things, provides for notice to potentially affected small governments, if any, and for a meaningful and timely opportunity to provide input in the development of regulatory proposals.

The FAA determines that this final rule does not contain a significant intergovernmental or private sector mandate as defined by the Act.

Energy Impact

The energy impact of the rulemaking document has been assessed in accordance with the Energy Policy and Conservation Act (EPCA) and Public L. 94–163, as amended (42 U.S.C. 6362). It has been determined that it is not a major regulatory action under the provisions of the EPCA.

Environmental Analysis

FAA Order 1050.1D defines FAA actions that may be categorically excluded from preparation of a National Environmental Policy Act (NEPA) environmental assessment or environmental impact statement. In accordance with FAA Order 1050.1D, appendix 4, paragraph 4(j), this rulemaking action qualifies for a categorical exclusion.

List of Subjects

14 CFR Part 27

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

14 CFR Part 29

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

The Amendments

In consideration of the foregoing, the Federal Aviation Administration amends parts 27 and 29 of Chapter I, Title 14, of the Code of Federal Regulations as follows:

PART 27—AIRWORTHINESS STANDARDS: NORMAL CATEGORY ROTORCRAFT

1. The authority citation for part 27 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

2. Amend § 27.25 by revising paragraph (c) to read as follows:

§ 27.25 Weight limits.

* * * * *

(c) *Total weight with jettisonable external load.* A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established under paragraph (a) of this section may be established for any rotorcraft-load combination if—

(1) The rotorcraft-load combination does not include human external cargo,

(2) Structural component approval for external load operations under either § 27.865 or under equivalent operational standards is obtained,

(3) The portion of the total weight that is greater than the maximum weight established under paragraph (a) of this section is made up only of the weight of all or part of the jettisonable external load,

(4) Structural components of the rotorcraft are shown to comply with the applicable structural requirements of this part under the increased loads and stresses caused by the weight increase over that established under paragraph (a) of this section, and

(5) Operation of the rotorcraft at a total weight greater than the maximum certificated weight established under paragraph (a) of this section is limited by appropriate operating limitations under § 27.865(a) and (d) of this part.

3. The undesignated center heading preceding § 27.865 is revised as set forth below; and in § 27.865 the section heading, paragraph (a) introductory text and paragraph (b) are revised; paragraphs (c) and (d) are redesignated as (e) and (f) and revised; and new paragraphs (c) and (d) are added to read as follows:

External Loads

§ 27.865 External loads.

(a) It must be shown by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for nonhuman external cargo applications can withstand a limit static load equal to 2.5, or some lower load factor approved under §§ 27.337 through 27.341, multiplied by the maximum external load for which authorization is requested. It must be shown by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under §§ 27.337 through 27.341, multiplied by the maximum external load for which

authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, must be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load must also be applied in any direction making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if—

* * * * *

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, must include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system must consist of a primary quick release subsystem and a backup quick release subsystem that are isolated from one another. The quick-release system, and the means by which it is controlled, must comply with the following:

(1) A control for the primary quick release subsystem must be installed either on one of the pilot's primary controls or in an equivalently accessible location and must be designed and located so that it may be operated by either the pilot or a crewmember without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(2) A control for the backup quick release subsystem, readily accessible to either the pilot or another crewmember, must be provided.

(3) Both the primary and backup quick release subsystems must—

(i) Be reliable, durable, and function properly with all external loads up to and including the maximum external limit load for which authorization is requested.

(ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release.

(A) The minimum level of protection required for jettisonable rotorcraft-load combinations used for nonhuman external cargo is a radio frequency field strength of 20 volts per meter.

(B) The minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per meter.

(iii) Be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft must—

(1) For jettisonable external loads, have a quick-release system that meets the requirements of paragraph (b) of this section and that—

(i) Provides a dual actuation device for the primary quick release subsystem, and

(ii) Provides a separate dual actuation device for the backup quick release subsystem;

(2) Have a reliable, approved personnel carrying device system that has the structural capability and personnel safety features essential for external occupant safety;

(3) Have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, the ingress and egress instructions;

(4) Have equipment to allow direct intercommunication among required crewmembers and external occupants; and

(5) Have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations.

(d) The critically configured jettisonable external loads must be shown by a combination of analysis, ground tests, and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under § 27.25 and this section.

(f) The fatigue evaluation of § 27.571 of this part does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of § 27.571 of this part applies to the entire quick release and personnel carrying device structural systems and their attachments.

PART 29—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

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

Authority: 49 U.S.C. 106(g), 40113, 44701-44702, 44704.

5. Amend § 29.25 by revising paragraph (c) to read as follows:

§ 29.25 Weight limits.

* * * * *

(c) *Total weight with jettisonable external load.* A total weight for the rotorcraft with a jettisonable external load attached that is greater than the maximum weight established under paragraph (a) of this section may be established for any rotorcraft-load combination if—

(1) The rotorcraft-load combination does not include human external cargo,

(2) Structural component approval for external load operations under either § 29.865 or under equivalent operational standards is obtained,

(3) The portion of the total weight that is greater than the maximum weight established under paragraph (a) of this section is made up only of the weight of all or part of the jettisonable external load,

(4) Structural components of the rotorcraft are shown to comply with the applicable structural requirements of this part under the increased loads and stresses caused by the weight increase over that established under paragraph (a) of this section, and

(5) Operation of the rotorcraft at a total weight greater than the maximum certificated weight established under paragraph (a) of this section is limited by appropriate operating limitations under § 29.865 (a) and (d) of this part.

6. The undesignated center heading preceding § 29.865 is revised as set forth below; and in § 29.865 the section heading, paragraph (a) introductory text and paragraph (b) are revised; paragraphs (c) and (d) are redesignated as (e) and (f) and revised; and new paragraphs (c) and (d) are added to read as follows:

External Loads

§ 29.865 External loads.

(a) It must be shown by analysis, test, or both, that the rotorcraft external load attaching means for rotorcraft-load combinations to be used for nonhuman external cargo applications can withstand a limit static load equal to 2.5, or some lower load factor approved under §§ 29.337 through 29.341, multiplied by the maximum external load for which authorization is requested. It must be shown by analysis, test, or both that the rotorcraft external load attaching means and corresponding personnel carrying device system for rotorcraft-load combinations to be used for human external cargo applications can withstand a limit static load equal to 3.5 or some lower load factor, not less than 2.5, approved under §§ 29.337

through 29.341, multiplied by the maximum external load for which authorization is requested. The load for any rotorcraft-load combination class, for any external cargo type, must be applied in the vertical direction. For jettisonable external loads of any applicable external cargo type, the load must also be applied in any direction making the maximum angle with the vertical that can be achieved in service but not less than 30°. However, the 30° angle may be reduced to a lesser angle if—

* * * * *

(b) The external load attaching means, for jettisonable rotorcraft-load combinations, must include a quick-release system to enable the pilot to release the external load quickly during flight. The quick-release system must consist of a primary quick release subsystem and a backup quick release subsystem that are isolated from one another. The quick release system, and the means by which it is controlled, must comply with the following:

(1) A control for the primary quick release subsystem must be installed either on one of the pilot's primary controls or in an equivalently accessible location and must be designed and located so that it may be operated by either the pilot or a crewmember without hazardously limiting the ability to control the rotorcraft during an emergency situation.

(2) A control for the backup quick release subsystem, readily accessible to either the pilot or another crewmember, must be provided.

(3) Both the primary and backup quick release subsystems must—

(i) Be reliable, durable, and function properly with all external loads up to and including the maximum external limit load for which authorization is requested.

(ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent inadvertent load release.

(A) The minimum level of protection required for jettisonable rotorcraft-load combinations used for nonhuman external cargo is a radio frequency field strength of 20 volts per meter.

(B) The minimum level of protection required for jettisonable rotorcraft-load combinations used for human external cargo is a radio frequency field strength of 200 volts per meter.

(iii) Be protected against any failure that could be induced by a failure mode of any other electrical or mechanical rotorcraft system.

(c) For rotorcraft-load combinations to be used for human external cargo applications, the rotorcraft must—

(1) For jettisonable external loads, have a quick-release system that meets the requirements of paragraph (b) of this section and that—

(i) Provides a dual actuation device for the primary quick release subsystem, and

(ii) Provides a separate dual actuation device for the backup quick release subsystem;

(2) Have a reliable, approved personnel carrying device system that has the structural capability and personnel safety features essential for external occupant safety;

(3) Have placards and markings at all appropriate locations that clearly state the essential system operating instructions and, for the personnel carrying device system, ingress and egress instructions;

(4) Have equipment to allow direct intercommunication among required crewmembers and external occupants;

(5) Have the appropriate limitations and procedures incorporated in the flight manual for conducting human external cargo operations; and

(6) For human external cargo applications requiring use of Category A rotorcraft, have one-engine-inoperative hover performance data and procedures in the flight manual for the weights, altitudes, and temperatures for which external load approval is requested.

(d) The critically configured jettisonable external loads must be shown by a combination of analysis, ground tests, and flight tests to be both transportable and releasable throughout the approved operational envelope without hazard to the rotorcraft during normal flight conditions. In addition, these external loads—must be shown to be releasable without hazard to the rotorcraft during emergency flight conditions.

(e) A placard or marking must be installed next to the external-load attaching means clearly stating any operational limitations and the maximum authorized external load as demonstrated under § 29.25 and this section.

(f) The fatigue evaluation of § 29.571 of this part does not apply to rotorcraft-load combinations to be used for nonhuman external cargo except for the failure of critical structural elements that would result in a hazard to the rotorcraft. For rotorcraft-load combinations to be used for human external cargo, the fatigue evaluation of § 29.571 of this part applies to the entire quick release and personnel carrying device structural systems and their attachments.

Issued in Washington, DC, on August 3, 1999.

Jane F. Garvey,

Administrator.

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Rotorcraft Draft Advisory Material

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of availability of draft rotorcraft advisory material.

SUMMARY: This is a notice of availability of draft Advisory Circular (AC) material, which provides guidance as to an acceptable means of accomplishing the requirements of proposed rules on the subject of normal and transport category rotorcraft load combination safety requirements and on the subject of normal category rotorcraft maximum weight and passenger seat limitation.

FOR FURTHER INFORMATION CONTACT: Kathy Jones, Rotorcraft Standards Staff, FAA, Rotorcraft Directorate, Aircraft Certification Service, Forth Worth, TX 76193-0110; telephone (817) 222-5359, fax (817) 222-5961.

SUPPLEMENTARY INFORMATION: This notice announces the availability of draft AC material. The FAA tasked the Aviation Rulemaking Advisory Committee (ARAC) to develop rulemaking and policy material for normal and transport category rotorcraft. The ARAC process is a means for the public to participate in the drafting of rules and advisory material. The FAA review of the ARAC Working Groups' material resulted in the FAA proposing Notices of Proposed Rulemaking (NPRM's) and AC material. Consequently, NPRM No. 98-6, ``Rotorcraft Load Combination Safety Requirements,'' was published in the Federal Register on July 13, 1998 (63 FR 37745). The accompanying AC material is available and will be published in a future revision to AC 27-1A and AC 29-2B (Certification of Normal Category Rotorcraft and Certification of Transport Category Rotorcraft, respectively). NPRM No. 98-4, ``Normal Category Rotorcraft Maximum Weight and Passenger Seat Limitation,'' was published in the Federal Register on June 25, 1998 (63 FR 34610). The accompanying AC material is available and will be published in a future revision to AC 27-1A (Certification of Normal Category Rotorcraft).

Issued in Fort Worth, Texas, on August 12, 1998.

Eric Bries,

Acting Manager, Rotorcraft Directorate, Aircraft Certification Service.

[FR Doc. 98-22387 Filed 8-19-98; 8:45 am]
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