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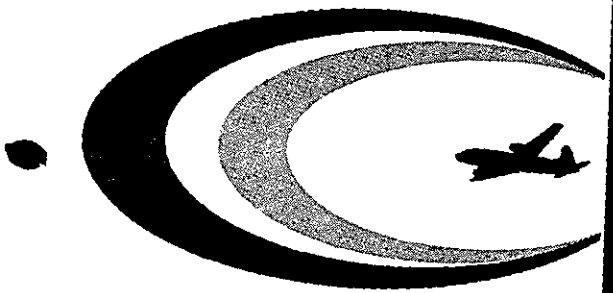
FLIGHT TEST GUIDE



MULTIENGINE AIRPLANE CLASS OR TYPE RATING

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

CONTENTS

MULTIENGINE AIRPLANE CLASS OR TYPE RATING

This Guide describes the acceptable performance of flight maneuvers and procedures on flight tests for the addition of multiengine ratings to Private and Commercial Pilot Certificates. Flight tests in multiengine airplanes for the issuance of Private and Commercial Pilot Certificates will be conducted in accordance with the appropriate *Private Pilot* or *Commercial Pilot Flight Test Guide*, using the descriptions contained in this Guide for the performance of those of the required maneuvers which are different for multiengine airplanes. The flight maneuvers and procedures required for Private and Commercial Pilot Certificates are prescribed in Sections 61.87 and 61.117 of the Federal Aviation Regulations.

The multiengine rating flight test described in this Guide is arranged in three phases: *Oral Operational Test*, *Basic Piloting Technique*, and *Multiengine Emergency Procedures*. The failure of any required item constitutes the failure of the phase involved, and of the flight test. A flight test may be discontinued at any time by the examiner or the applicant, but in the event of failure or an incomplete test, credit will be allowed on sub-

sequent reexamination for each successfully completed phase.

The section on each procedure or maneuver contains three paragraphs: *Objective*, *Description*, and *Acceptable Performance:*

The *Objective* states briefly the reason why the procedure or maneuver is required on the flight test. It specifies the principles which the applicant must apply, and the piloting operations which he must perform properly to demonstrate that he has mastered this element of pilot qualification.

The *Description* explains the procedure and means which have been found most effective in accomplishing and demonstrating the objectives of the procedure or maneuver. These descriptions must not be confused with the objectives. How one enters a stall, for example, is not so important as is his demonstration of the ability to recognize stalls and to use the proper recovery techniques, which are the objectives of the maneuver.

The *Acceptable Performance* describes the factors which are taken into account by the examiner in deciding whether the applicant has met the objectives of the procedure or maneuver. The airspeed, altitude, and heading tolerances are not hard-and-fast, but represent the performance to be expected in good flying conditions in a typical personal type airplane. The practice of consistently exceeding these tolerances before corrective

action is initiated, however, is indicative of an unsatisfactory performance.

A multiengine class rating issued on the basis of a flight test in a multiengine airplane which has no engine-out minimum control speed will bear the limitation LIMITED TO CENTER THRUST. Such airplanes typically have jet engines in or on the fuselage, or reciprocating engines in tandem on the center line of the fuselage.

A flight instructor's written recommendation is required by FAR 61.21 for each pilot flight test, except a test for the addition of a type rating only to a pilot certificate.

The applicant is required to provide a properly certificated airplane, bearing no limitations or restrictions which prevent its use for the test. A military aircraft on operational status is acceptable, provided its use is authorized by the appropriate military authority. The airplane should be equipped with such radio, instrumentation, and check list as is necessary for the required flight test operations. Fully functioning dual controls are required by FAR 61.25(b), unless, after considering all factors, the examiner determines that the flight test can be conducted safely without them.

PHASE I.

ORAL OPERATIONAL TEST

1. Airplane Registration, Airworthiness, and Equipment Documents

a. *Objective.* To determine that the applicant can identify and find the documents required in a certificated airplane.

b. *Description.* The applicant will be requested to present or point out in the airplane the aircraft registration, airworthiness certificate, *Airplane Flight Manual* (if required), equipment list, and weight and balance documents required to be carried in the airplane.

c. *Acceptable Performance.* The applicant should be able to identify, find, and explain the purpose and significance of each required document.

2. Airplane Logbooks and Airworthiness Inspection Records

a. *Objective.* To determine that the applicant knows what airworthiness inspections are required for a certificated airplane, and what evidence of these inspections is acceptable for flight operations.

b. *Description.* The applicant will be required to present and explain the aircraft and engine logbooks, or other required airworthiness inspection reports.

c. *Acceptable Performance.* The applicant should be able to identify, find, and explain the significance, to the pilot, of the required inspection reports.

3. Airplane Performance, Range, and Operation

a. *Objective.* To determine that the applicant knows what performance data and operating information is important to the pilot, and can obtain them for the airplane to be used for the test.

b. *Description.* The applicant will be required to demonstrate a practical knowledge of the performance capabilities, approved operating procedures, and limitations for the airplane furnished. This includes power settings, placard speeds, range, fuel and oil requirements, the operation of aircraft systems and special equipment, critical engine-out control and climb speeds, and other emergency procedures.

The applicant will be expected to use the *Airplane Flight Manual*, or *Owners Handbook* if available, to determine the effects of temperature, density altitude, wind, surface conditions, and gross weight on flight performance. He is expected to be familiar with the effects of power settings and altitude on the cruising range, and to know the airspeeds for best performance in the airplane used. Special attention will be devoted to the performance data on flight control and performance with an engine inoperative.

A practical knowledge of the control system; the fuel, lubrication, hydraulic,

and electrical systems; the operation of the supercharger(s), landing gear, and flaps, radio, pressurization, heating, and ventilation installations; and of the fire control, deicing and anti-icing, and other emergency equipment appropriate to the type of airplane used will be required.

c. *Acceptable Performance.* The inability to obtain essential pilot information which is available in the airplane, or a faulty knowledge of operating data or procedures is disqualifying.

4. Airplane Loading, Including Fuel, Oil, and Baggage Capacities

a. *Objective.* To determine that the applicant can make practical, accurate determinations of permissible loading and load distribution in an airplane.

b. *Description.* The applicant will be required to apply the approved weight and balance data for the airplane used on the test to make practical computations of the permissible fuel and payload distribution. A loading graph or computer designed for the airplane may be used for this purpose.

c. *Acceptable Performance.* The applicant should be able to make accurate determinations of permissible gross weight loadings, and load distribution.

5. Airplane Line Check

a. *Objective.* To establish that the applicant can make a practical determination that the airplane is ready for flight.

b. *Description.* The applicant will be

expected to use an orderly procedure in conducting a preflight check of the airplane, preferably in accordance with a check list provided by the manufacturer or operator. This check covers the airplane's readiness for flight, including fuel and oil supply, the presence of all required equipment and documents, and its airworthiness so far as can be determined by external inspection.

c. *Acceptable Performance.* The applicant should know the significance of each item checked, and not overlook any obvious unairworthy condition. He should know the appropriate remedial action for a pilot to initiate for the correction of each unsatisfactory item detected.

6. Use of Radio for Voice Communication.

a. *Objective.* To determine that the applicant can use two-way radio effectively for ground and flight communications.

b. *Description.* During his flight test, the applicant will be expected to use two-way radio for information, clearances, and requests pertinent to the flight.

c. *Acceptable Performance.* Performance will be evaluated on the basis of the applicant's ability to determine and tune in the correct radio frequencies, and his use of appropriate radio procedures and phraseology.

PHASE II.

BASIC PILOTING TECHNIQUES

1. Preflight Operations

a. *Objective.* To determine that the applicant knows how to start and warm up the engines, and to determine the airplane's immediate readiness for flight.

b. *Description.* The applicant will be expected to perform the proper procedures for the airplane used in engine starting, warmup, and runup; the setting of the airplane systems and equipment; and the check of the flight controls.

c. *Acceptable Performance.* The procedures used should be correct and thorough, and should be conducted in accordance with an appropriate checklist. Performance will be evaluated on the basis of the accuracy of the procedures used, and the thoroughness of the engine, systems, and airplane checks.

2. Taxiing, or Sailing and Docking

a. *Objective.* To determine that the applicant has the ability to maneuver the airplane expeditiously and safely on the surface.

b. *Description.* The demonstration of taxiing will include the operation of the airplane on the surface, the initial and continuing determination that the taxi

path is clear of obstructions, and compliance with local taxi rules and control tower instructions.

Seaplane applicants will be required to demonstrate taxiing at slow speeds and on the step, sailing, docking, a simulated or actual approach to a buoy, and turns to downwind headings.

c. *Acceptable Performance.* Performance will be evaluated on the basis of the accuracy of taxi operations; safety; consideration for other aircraft and personnel on ramps and taxiways; the use of power, brake, and flight controls for directional control; and the proper use of nosewheel steering, tailwheel lock, or water rudder, if the airplane is so equipped.

3. Normal and Crosswind Takeoffs and Landings

a. *Objective.* To determine that the applicant is able to make consistently safe takeoffs and landings under all normally anticipated conditions.

b. *Description.* The applicant will be required to demonstrate normal and crosswind takeoffs and landings. If all takeoffs and landings must be made with sufficent crosswind to require the use of crosswind techniques, no separate demonstrations will be required. For safety, crosswind takeoffs and landings must be performed with full consideration for other air traffic, and in strict compliance with the crosswind component limitations for landings in the airplane used.

Landings will be required at various

flap settings, including a no-flap landing if permitted by the airplane's operating limitations.

The applicant will also be required to demonstrate maximum performance (short field) takeoffs and landings. Lift-off should be initiated just below the all-engine best angle of climb speed, unless it is slower than the engine-out minimum control speed, in which case the engine-out minimum control speed should be used. The best all-engine angle of climb speed should be attained, and maintained to the height of an assumed obstruction, such as a fence or row of trees, after which normal climb speed should be smoothly attained.

For short field landings, the final approach from an altitude of at least 50 feet above the surface should be made at approximately 1.3 times the power-off stalling speed with gear and flaps extended. Descent should be controlled primarily with the throttles and the airspeed with the elevators. The round-out for landing should be accompanied by a smooth closing of the throttles, and result in little or no floating.

c. *Acceptable Performance.* Performance will be evaluated on the basis of takeoff and landing technique, judgment, observance of traffic patterns and control tower instructions, drift correction, coordination, and smoothness. Excessive maneuvering, faulty operation of aircraft controls or systems, or the use of improper airspeeds will be disqualifying.

4. Emergency Go-arounds

a. *Objective.* To determine that the applicant can operate all systems correctly when abandoning a landing approach and going around again in the event of an emergency, such as an unexpected obstruction on the runway.

b. *Description.* Just prior to touchdown in landing configuration, the examiner will direct the applicant to execute a go-around without prior notice. The execution of a go-around with a simulated engine failure will not be required.

c. *Acceptable Performance.* The applicant's performance will be evaluated on the basis of his ability to maintain the appropriate airplane control and performance speeds, the correct handling of the flaps and gear, and the use of correct power and trim settings. Climbing higher than necessary to clear immediate obstructions at less than the minimum engine-out control speed will be disqualifying.

5. Maneuvering at Minimum Controllable Airspeed

a. *Objective.* To determine the applicant's ability to recognize and maintain safe flight control at marginally slow airspeeds, and to make the transition from cruising to landing approach speeds smoothly.

b. *Description.* The applicant will be required to maneuver the airplane at an airspeed not more than 10 knots above the stalling speed in cruise and in landing

configurations. The transition from and to cruising configuration and airspeed in straight and level flight will be required.

c. *Acceptable Performance.* During maneuvers at minimum controllable airspeed, the applicant will be expected to maintain a speed within 5 knots of the desired airspeed, and an altitude within 100 feet of the original altitude. In straight and level flight and during the transition to and from the minimum controllable airspeed, he will be expected to maintain a heading within 10 degrees of the original heading. Consideration will be given to the applicant's use of the proper trim and power settings. Any unintentional stall will be disqualifying.

6. Stalls and Partial Stalls

a. *Objective.* To determine that the applicant can recognize a partial stall, and make prompt, effective recoveries from partial and complete stalls.

b. *Description.* The applicant will be required to demonstrate stalls entered with at least 65 percent power and with power reduced on all engines, in landing and in cruising configurations. Stalls should be entered by increasing the angle of attack smoothly, so that the airspeed decreases at a uniform rate. Sufficient power may be used throughout all stalls to keep the engines running smoothly.

No stall will be required with any engine throttled or cut off and the other engine(s) developing effective power. Abrupt pitch changes during stall dem-

onstrations, and all other maneuvers, should be avoided in airplanes with extensions between the engine and the propeller, because of the high gyroscopic loads induced.

Recoveries should be initiated at the first physical indication of a stall, such as uncontrollable pitching, buffeting, rapid decay of control effectiveness, or the application of full back elevator without producing further stall development. The applicant should control the attitude of the airplane to the maximum extent possible throughout the stall and recovery by the normal use of the flight controls. Emphasis will be placed on the recovery from a stabilized high rate of descent in a high pitch attitude, if this condition develops in some flight situations in the airplane used.

Stall recoveries should be accomplished positively and smoothly, with coordinated flight control usage, the smooth application of power, and the least loss of altitude consistent with the prompt recovery of control effectiveness.

c. *Acceptable Performance.* Throughout stall demonstrations, the applicant will be expected to use prompt and correct control applications to achieve the desired attitudes and maintain the desired heading. Consideration will be given to the applicant's positive action and smoothness. Failure to initiate corrective action on partial stalls before the nose pitches uncontrollably, indications of a secondary

stall during recoveries, or diving to higher than cruising airspeed during recovery will be disqualifying.

7. Steep Turns

a. *Objective.* To determine the applicant's ability to control an airplane in a steep bank under maneuvering load factors, and to maintain altitude and orientation.

b. *Description.* Turns in level flight with banks of at least 45 degrees will be required, continuing for 360° or 720°.

c. *Acceptable Performance.* The applicant will be expected to maintain an altitude within 100 feet of the entry altitude, and a bank within less than 10° of variation after the turn is established, and complete recoveries within 10° of the assigned headings. Special attention will be directed to the applicant's smoothness, coordination, and orientation.

8. Instrument Flight (Type Ratings, per FAR 61.17(j))

a. *Objective.* To determine that the applicant is competent to operate the airplane for which a type rating is sought under instrument flight rules. (An applicant who does not hold an instrument rating will not be required to demonstrate instrument competency to obtain a type rating. The holder of an instrument rating who elects not to demonstrate his instrument proficiency may be issued a type rating with the restriction VFR ONLY.)

b. *Description.* The applicant for a type rating will be required to demonstrate the competent performance of the following procedures and maneuvers solely by reference to instruments:

i. Recovery from unusual flight attitudes,

ii. Stall recoveries,

iii. A standard instrument approach,

iv. Maneuvering with one engine inoperative—propeller feathered or power reduced to simulate the drag of a feathered propeller—, and

v. Instrument emergencies.

c. *Acceptable Performance.* The standards for the performance of these procedures and maneuvers will be in accordance with those in the FAA *Instrument Pilot Flight Test Guide.*

PHASE III.
MULTIENGINE EMERGENCY PROCEDURES

1. Maneuvering with One Engine Out (Feathered if Possible)

a. *Objective.* To determine that the applicant can use the correct procedures for feathering or shutting down an engine in flight, and that he can maneuver an airplane effectively and safely with an engine inoperative.

b. *Description.* The feathering of one propeller will be required on a flight test in any multiengine airplane equipped with propellers which can be safely feathered and unfeathered in flight. Feathering for pilot flight test purposes will be required only under such conditions and at such altitudes and positions where safe landings on established airports can be readily accomplished in the event difficulty is encountered in unfeathering.*

If the airplane used is not equipped with propellers which can be safely feath-

*NOTE: The regulations do not specifically require an applicant to unfeather a propeller on a flight test. Accordingly, he will not be required to do so if he elects to land with a propeller feathered. If he desires to use this procedure, he should arrange it in advance with the examiner concerned, who will permit it unless he considers that an undue hazard would be involved.

ered or unfeathered in flight, the applicant will be required to shut down one engine in flight in accordance with the procedures in the *Airplane Flight Manual.*

While one engine is feathered or shut down, the applicant will be required to demonstrate straight and level flight, and 20° to 30° banked turns toward and away from the inoperative engine. Climbs and descents to prescribed altitudes will be required in airplanes which are capable of climbing under the existing conditions.

The prescribed propeller operation procedures will be expected, as well as the emergency settings of all ignition, fuel, electrical, hydraulic, and fire extinguishing systems appropriate to an engine failure.

c. *Acceptable Performance.* The applicant's performance will be evaluated on the basis of his ability to maintain his heading within 20 degrees of the original heading during his feathering and unfeathering procedures, and his altitude within 100 feet of the original altitude if it is within the capability of the airplane used; prompt indentification of the inoperative engine after a simulated power failure; and the accuracy of his shutdown and restart procedures, as prescribed in the *Airplane Flight Manual* or *Owners Handbook.* In an airplane not capable of maintaining altitude with an engine inoperative under existing circumstances,

the applicant will be expected to maintain an airspeed within 5 knots of the engine-out best rate-of-climb speed. The use of prescribed operating procedures, proper trim settings, and smoothness will be emphasized.

2. Engine-Out Minimum Control Speed Demonstration

a. *Objective.* To determine that the applicant knows the significance of the engine-out minimum control speed, and the effect of attempts to maintain flight at a slower speed with an engine inoperative.

b. *Description.* With the critical engine (usually the left) windmilling (not cut off), or set to simulate the drag of a feathered propeller if the airplane is equipped with auto-feathering, the gear and flaps retracted, and the operating engine(s) producing as nearly rated power as possible, the airspeed should be reduced slowly with the elevators until an uncontrollable turn or bank toward the inoperative engine or indication of a stall is first detected. The airspeed at which an uncontrollable turn or bank first occurs is the engine-out minimum control speed for the conditions under which the demonstration is conducted.

Continued controlled flight at a slower airspeed is impossible, unless the difference in the power being produced by the engines is reduced. Recovery must be initiated AT THE FIRST INDICATION OF THE LOSS OF DIRECTIONAL OR LATERAL CONTROL

by reducing the power on the operating engine(s) and reducing the angle of attack by lowering the nose slightly.

Great caution must be observed when it is seen that the engine-out minimum control speed under existing conditions is close to the stalling speed. Loss of directional control at the instant of a stall can lead to the sudden complete loss of control.

To obtain an engine-out minimum control speed as far as possible above stalling speed, it is necessary to perform this demonstration under conditions in which the engines will produce as nearly their rated power as possible. For this reason it is most effective to use as low an altitude as is operationally safe, keeping in mind the possibility of a loss of control in the event the effect is not immediately recognized.

With unsupercharged engines, there is a density altitude above which the stalling speed is higher than the engine-out minimum control speed. When this density altitude exists close to the ground because of high elevations or temperatures, an effective flight demonstration is impossible and will not be attempted. When a flight demonstration is impossible, the significance of the engine-out minimum control speed will be emphasized on the oral, including the results of attempting engine-out flight at below this speed, the recognition of imminent loss of control, and recovery techniques.

c. *Acceptable Performance.* The applicant must have a complete and accurate knowledge of the cause, effect, and significance of the engine-out minimum control speed, and of the clues to be watched for by the pilot and the safe recovery procedures.

The engine-out minimum control speed flight demonstration is subject to so much variation because of differences in airplane flight characteristics, circumstances of flight, and density altitude that definitive performance standards cannot be prescribed. The basic criteria are the prompt recognition of imminent loss of control, and the prompt initiation of correct recovery actions. An attempt at any time during the flight test to continue level or climbing flight with an engine out at less than the engine-out minimum control speed, except as necessary for this demonstration, will be disqualifying.

3. Use of Engine-Out Best Rate-of-Climb

a. *Objective.* To determine that the applicant knows and can effectively apply the best rate-of-climb airspeed for the airplane used.

b. *Description.* The applicant will be required to establish and maintain the best possible rate of climb (or minimum rate of sink) with one engine throttled to simulate the drag of a feathered propeller, or with a propeller feathered by mutual agreement between the applicant and examiner. This climb should be main-

tained for at least three minutes after the airspeed is established, at maximum continuous power, and the resulting climb carefully noted. He may then be asked to attempt to gain more altitude at higher or lower airspeeds of his own choosing or selected by the examiner, for comparison with the airspeed initially selected.

c. *Acceptable Performance.* Performance will be evaluated on the basis of the applicant's ability to determine (fr[illegible] the *Airplane Flight Manual*) and maintain the prescribed engine-out best rate-of-climb speed. He will be expected to maintain a climb within 5 knots of the best rate-of-climb speed within 10 degrees of the desired heading.

4. Effects of Airplane Configuration on Engine-Out Performance

a. *Objective.* To determine that the applicant is aware of the detrimental effects on engine-out performance of various common airplane configurations, and to prepare him to evaluate these effects in unfamiliar airplanes.

b. *Description.* The airplane should be trimmed to its engine-out best rate-of-climb speed with the power on one engine throttled to simulate the drag of a feathered propeller, or with a propeller feathered. The effects of the extension of the landing gear, the flaps, and both; the application of carburetor heat on the operating engine(s); and the windmilling of the inoperative engine should be observed a[illegible] the resulting climb or descent carefu[illegible]

noted. The difference between the gear and the flap extension drag should be emphasized. Each configuration will be maintained long enough to allow its effect to stabilize before the resulting climb or descent is measured. Prolonged use of carburetor heat should be avoided at high power settings.

c. *Acceptable Performance.* Performance will be evaluated on the basis of the accuracy of operations and trim procedures used, and on the applicant's ability to maintain an airspeed within 5 knots of the best rate-of-climb speed and a heading within 10 degrees of the assigned heading.

5. Engine-Out Approach and Landing

a. *Objective.* To determine the applicant's ability to execute a safe approach and landing after the failure of an engine.

b. *Description.* The applicant will be required to demonstrate an approach and landing with one engine inoperative. In the event the applicant has elected to land with a propeller feathered after demonstrating propeller feathering under paragraph 1 of Phase III, no further demonstration will be required. Otherwise, the landing may be made with an engine throttled to simulate the drag of a feathered propeller or, if feathering propellers are not installed, with an engine throttled to idling. The approach will be continued to a normal landing, no go-around with an engine out will

be required unless there is an actual emergency.

c. *Acceptable Performance.* Performance will be evaluated on the basis of the correct operation of the airplane systems, the use of appropriate trim settings, observance of the regular traffic pattern or approach path, airspeed and altitude control, accuracy of touchdown, and control during rollout. Any reduction of airspeed below the engine-out minimum control speed before the landing flare is initiated will be disqualifying.

6. Emergency Operations

a. *Objective.* To determine that the applicant is familiar with the emergency operation of all regular and special systems in the airplane used for the test.

b. *Description.* The applicant will be required to demonstrate the actual emergency operation of the retractable gear; flaps; and electrical, fuel, deicing, and hydraulic systems. Emergency operations such as the use of CO_2 pressure for gear extension, or the discharge of a pressure fire extinguisher system will be simulated only.

At least once during the flight test, the examiner will throttle an engine on takeoff, and expect the applicant to proceed as he would in the event of an actual power failure. If it has been determined that the engine-out rate of climb under existing circumstances is at least 50 feet per minute at 1,000 feet above the airport,

and he has attained at least the engine-out best angle of climb speed when the engine is throttled, the applicant will be expected to continue his takeoff with one engine throttled.

If the airspeed is below the engine-out best angle of climb speed and the landing gear has not been retracted, the takeoff should be abandoned immediately. If the best angle of climb speed has been attained and the landing gear is in the retract cycle, the applicant will be expected to climb out at the engine-out best angle of climb speed to the height of any obstructions, and thereafter stabilize the airspeed at the engine-out best rate of climb speed while cleaning up the airplane and resetting all appropriate systems.

The feathering of the propeller and securing of the throttled engine will be simulated to keep it available for immediate use, but all other settings will be made as in the case of an actual power failure. If it has been determined that the engine-out rate of climb will be at least 50 feet per minute at 1,000 feet above the airport, the examiner will, at least once during the flight test, throttle an engine on takeoff after reaching a reasonable speed determined by giving due consideration to the airplane's characteristics, runway length, surface conditions, wind direction and velocity, and any other factors which may affect safety.

On flight tests in pressurized airplanes, the applicant will be required to execute an emergency descent, as might be necessitated by a loss of pressurization, in accordance with the procedures prescribed by the *Airplane Flight Manual* or *Owners Handbook*. The descent will be initiated and stabilized, but no prolonged descent will be required. The airspeed or Mach number used for the demonstration of an emergency descent will be approximately 10 percent less than the airplane's structural limitation, to provide a margin for error. When a Mach limitation is controlling at operational altitudes for the airplane used, the descent will be arranged, if practicable, to require the transition from the observance of the Mach limitation to an airspeed limitation. No simulated emergency descent will be permitted through or near clouds.

c. *Acceptable Performance.* Performance will be evaluated on the basis of the applicant's knowledge of the emergency procedures for the airplane used, the judgment displayed, and the accuracy of his operations.