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TANZANIA CIVIL AVIATION AUTHORITY
Aeronautical Information Services

AERONAUTICAL INFORMATION CIRCULAR

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This following circular is hereby promulgated for information, guidance and necessary action.

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Director General

GUIDANCE TO TRAINING PILOTS - SIMULATION OF ENGINE FAILURE IN AEROPLANES

1. **General**

1.1 Training Pilots conducting conversion training on to new aircraft types are not required to hold a Flying Instructor Rating (unless giving instruction for first multi-engine conversions) and need not have received formal instruction in the teaching and demonstration of action to be taken after engine-failure. Although operators now carry out a significant amount of training in flight simulators, there is a continuing need for in flight training because simulators are not available for all aircraft types and initial type rating tests require that ability to deal with an engine failure during or just after take-off be demonstrated in an aeroplane in flight. This Circular is intended to give guidance on the methods to be used to secure the highest possible standard of safety in ouch exercises.

2. **Preparation for Flight**

2.1 Thorough briefing of all crew members is essential. Particular emphasis should be placed on minimum heights and control speeds, the conduct of drills, the method of simulating engine failure and all aspects of the prevailing weather conditions. The use and effects of systems particularly relevant to asymmetric flight such as auto feathering and rudder boost should be discussed in detail.

2.2 Account must be taken of the possible effects on the circuit pattern caused by other traffic, particularly where aircraft with widely varying performance characteristics are using the same runway. Touch and go landings demand a particularly high level of crew coordination and the briefing should include precise details of the action to be taken by the trainee and training pilot respectively in relation to the initiation of drills and the setting of throttles, flaps, airbrakes and other controls.

2.3 When training is to be conducted away from the aerodrome of departure, preflight planning should take into account the need for ready access to a diversion aerodrome. This is particularly important where engine shutdown is to be completed in a twin engine aeroplane.

3. In Flight Procedures:

3.1 Engine failure during take-off or below the minimum heights recommended in this Appendix should be simulated only by reducing power, and never by complete shutdown of the engine. The best method of simulation by power reduction will vary from one class of aeroplane to another. Detailed guidance is given in para 6.

3.2 Immediately before failure is simulated the Training Pilot must position his feet so that he can prevent any application of wrong rudder by the trainee. During and after the simulation, he must be particularly vigilant in monitoring airspeed, heading, pitch and roll attitude, rudder position and yaw indication. He must also carefully monitor engine instruments especially on those types of aeroplanes in which genuine failure of the idling engine would produce an abnormal hazard.

He must ensure that any recommended bank angle is correctly applied and after ensuring safe initial rudder application he should monitor the trainees rudder input by resting his feet lightly on the rudder pedals. He should bring to the trainee's attention any tendency for flight parameters to more significantly from their target values. Except at a height which he knows to be safe, the Training Captain must never allow the trainee to retain control if, due to incorrect technique, the airspeed is reducing towards minimum control speed. Only at a height which is known to be safe in relation to the control characteristics of the aeroplane, should the Training Captain demonstrate, or permit the occurrence of, an actual loss of control to the extent that it is necessary to increase airspeed and reduce power in order to regain directional control.

When power failure is simulated during take-off, the speed should always be at or above VI and the Training Pilot should assume control if there is any indication that action by the trainee is leading to a reduction below these levels. If either a reduction of power or height loss is necessary for the retention of control, the Training Captain must consider whether he simulated failure at too low a speed or whether he took over control too late.

4. Performance Considerations:

4.1 When VMCG is assessed during certification the maximum cross component assumed is 7 kts. Training Pilots must only simulate engine failure on take-off with a higher crosswind component when they are certain that the speed chosen for the simulation will in the prevailing conditions, allow an adequate margin of control. Engine failure should never be simulated in crosswind component exceeding 1.5 kts.

The existence of any crosswind makes the monitoring of the trainee's rudder input, and the correction of any degree of wrong or inadequate movement, a critical requirement.

4.2 **Performance Group:**

A continued takeoff following simulated engine failure during the ground run should only be practiced in aeroplanes certificate in Performance Group A. On aeroplanes in other Performance Groups, simulation of an engine failure on the take-off roll must be followed by an abandoned take-off and should only be practiced at a safe speed and with sufficient runway remaining for the trainee to bring the aeroplane safely to a halt. Particular attention must be paid to runway conditions and the consequences of brake overheating.

5. **Actual Engine Shutdown:**

For the majority of pilots an actual engine failure or premeditated shutdown is a rare event. It is particularly important therefore that operators allocate adequate time for refresher training in the appropriate drills and procedures. Ideally, this training should take place in conjunction with the biannual base check and Training Pilots should emphasize the need to complete drills calmly and methodically and stress the importance of acting without haste. It should be remembered that, during certification tests, a reasonable allowance is made for Pilot reaction time, and that incomplete and over hasty drills are known to have been the cause of a significant number of accidents and incidents. The importance of the methodical completion of drills cannot be over emphasized.

Whenever refresher training involving shutdown is carried out in an aircraft in flight, Training Pilots must be aware of the time required to re start an engine. In the event, of an actual failure of a second engine during an engine shutdown demonstration.

Recommended safe heights for practicing exercises involving engine shutdown are detailed In the Appendix.

6. Recommended Techniques for simulating Engine Failure on Take-Off:

6.1 Turbojet and Turbofan Engines.

The Flight Manual VMCG is established on the basis of an instant fuel cut occurring and when the procedure is practiced in a flight simulator that method should be adopted. However, when practiced in an aircraft, good air man-ship requires smooth handling of all controls and the throttle should be closed at a rate commensurate with the engine's deceleration behavior. It may then be advisable, with certain engines, to position the power lever slightly forward of 'idle' in order to reduce response time if subsequent acceleration of the engine should be required.

6.2 Turboprop Engines: -

The simulation of engine failure by throttling back can introduce particular handling and performance problems. The primary problem arises from the fact that, a turboprop engine which has been throttled back to flight idle will produce very much more drag than, an engine which has failed and auto feathered. A further problem is that any automatic feathering or drag limiting devices fitted are usually made inoperative when the throttle is closed. Consequently, if an engine which has been throttled back to stimulate failure suffers a real failure; it may go to a very high drag 'wind milling' condition, remaining un-feathered unless correct feathering action is taken by the crew. Furthermore because the engine is in a low power condition, failure may not be noticed until after severe handling difficulties have arisen. There will also be a reduction in performance which may well lead to decay in airspeed and an inability to maintain adequate clearance over obstacles. Any such loss in airspeed can of course contribute to the loss of directional control.

These potential problems can best be avoided by appropriate methods of simulating engine failure. Advice from engine or aircraft manufacturer's specific to type should be followed, but where this is lacking, the following general advice is likely to be appropriate:-

i) on aircraft equipped with auto feather the throttle should be moved smoothly towards the closed position until a predetermined torque reading, approximating to zero thrust, is obtained. In this condition, the Flight Manual speeds and performance which are based on a feathered engine will be valid and the handling qualities will match a real failure situation. The torquemeter

should be monitored during the remainder of the take-off and initial climb, and if the torque fails, the throttle should be opened fully;

ii) on aircraft not equipped with auto feather the throttle may be moved smoothly to the closed position because an actual failure of the idling, engine does not present an abnormal hazard. When the trainee has identified the 'failed' engine and completed the 'touch only' feathering drill, the throttle should be advanced to a zero thrust setting.

6.3 Piston Engines:

Generally the throttle may initially be moved smoothly to the closed position; the mixture control or idle cut-off should not be used to simulate engine failure. Reference to the engine manufacturer's recommendations should clarify the technique in particular cases.

When the trainee has identified the 'failed' engine and completed his 'touch only' feathering drill, the throttle should be advanced to the zero thrust position.

APPENDIX: TO AIC 20/2000
RECOMMENDED MINIMUM SAFE HEIGHTS FOR COMPLETE SHUTDOWN OF POWER PLANTS FOR TRAINING PURPOSES:

a)	piston or turboprop engine aeroplanes with maximum total weight authorized	3,000 feet AGL
b)	Four engine aeroplanes.	4,000 feet AGL
c)	(i) Twin piston or turboprop engine aeroplanes with	4,000 feet AGL
	(ii) Triple turbojet or turbo fan engine aeroplanes.	
d)	Twin turbo jet or turbo fan engine aeroplanes.	8,000 feet AGL

* **For four engine Performance Group A aeroplanes.**

This height may be reduced to 1500 feet above ground level provided that the aeroplane's instantaneous weight is such as to permit a gross rate climb of at least 200 feet per minute in the 2 engine out en route configuration. Since different types of aeroplanes have widely differing characteristics, the advice of the Authority should be taken if there is any doubt about the safety of methods and procedure to be adopted for any particular type/mark.

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