

Part I

Chapter 10—Aircrew Equipment Assembly and Oxygen System

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WARNING: Both ejection seats must be rendered safe for parking, whenever the aircraft is on the ground, by inserting safety pins in the :

- Seat pan handle (Post-Mod. ES2158)
- Ejection gun firing unit sear
- Canopy jettison and time delay unit trip lever

- Canopy jettison firing unit sear
- Control column snatch unit firing unit sear (Post-Mod. CJ 44)

1 General

The aircraft equipment assemblies consist of the seats, the flying and safety clothing and associated equipment, including oxygen connections. The description of these items and their use is covered in the following paragraphs. Ejection seats are provided for the

◀ pilots and static seats for the rear crew members. Post-Mod 3295, swivel seats are fitted for the rear crew members and the sixth seat is fitted with an assister cushion.

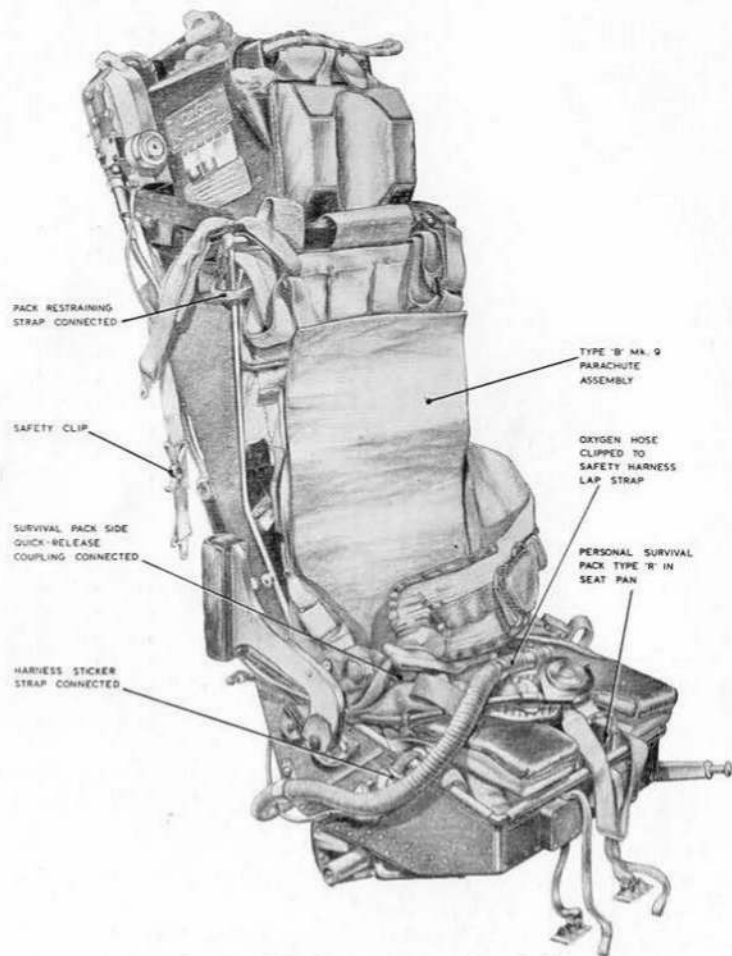


Fig. 1 Ejection seat equipped (1)

Ejection seats

2 Seats, general

(a) The ejection seats, Mk. 3L1 for the 1st pilot and Mk. 3L2 for the 2nd pilot, are similar but partially handed. Each seat carries a Mk. 9 parachute assembly, Type ZF harness, a personal survival pack type R and emergency oxygen bottle.

(b) The seat pan is adjustable for height, by means of a lever on the outboard side of the seat. The trigger in the end of the lever must be depressed before the height can be adjusted and, when released, locks the seat in the selected position.

(c) A lean-forward lever, forward on the inboard side of each seat, allows the occupant to lean forwards, by unlocking the attachment between the shoulders and the back of the seat. If the lever is released, the forward position can be held but, on sitting back again, the slack is automatically taken up and locked against renewed forward movement.

(d) The adjustable armrests are controlled by either of two levers on each rest, one at the forward end and one at the rear, on the side of the rest.

3 Ejection gun and firing handles

Each set is fitted with an 80 ft./sec. telescopic ejection gun, which can be fired by either of two handles; the face screen firing handle, to which is attached a face blind, is above the occupant's head and is B-shaped. The seat pan firing handle, for use in conditions of high G or when it is otherwise impossible to reach the blind handle, is in the front of the seat. Either handle must be pulled to its full extent to fire the gun. Safety pins are provided, one for each firing handle. Mod. 3008 introduces a guard over the canopy jettison gun sear on the 1st pilot's ejection seat.

4 Drogue gun

The drogue gun has a time-delay mechanism and fires half a second after the ejection gun has fired, withdrawing the duplex

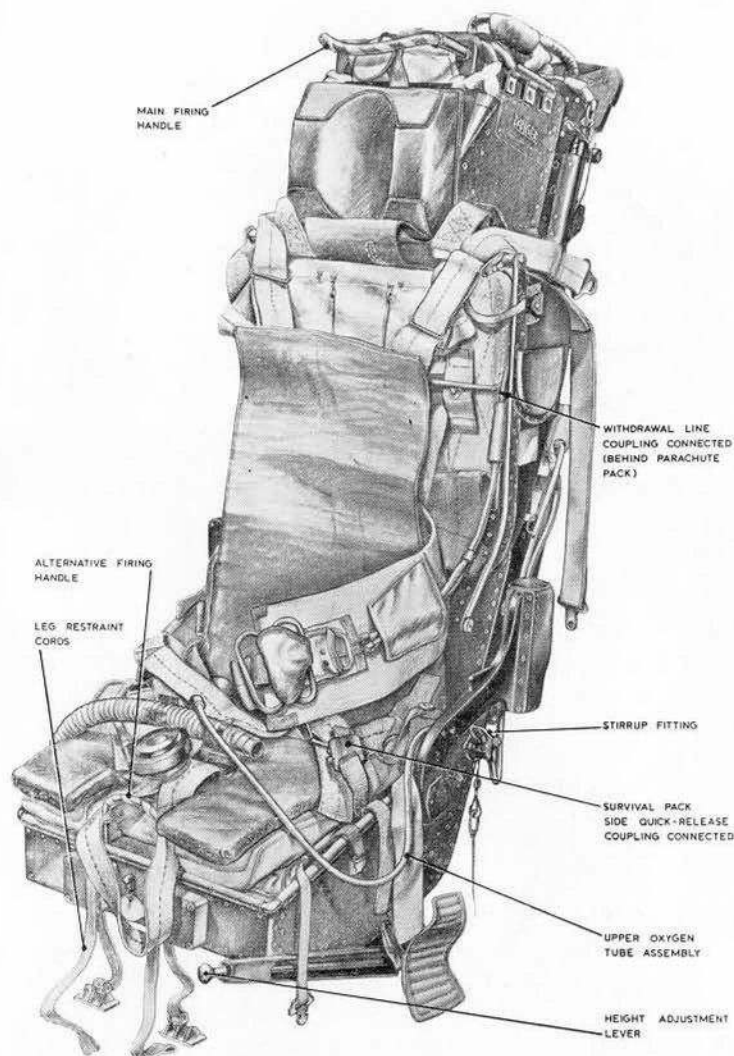


Fig. 2 Ejection seat equipped (2)

drogues to stabilise the seat. The time-delay mechanism is operated by a static trip rod, which withdraws a sear from the gun as the seat rises on the rails.

NOTE: Before flight, check that the drogue withdrawal line (between the gun and the flap securing pin) passes *over* the black lifting line (between the scissors shackle and securing pin on the side of the head-box).

5 Barostat/G-stop time-delay

(a) A barostat-controlled mechanism delays automatic separation from the seat until it is below 10,000 feet. Below this height, the mechanism operates after a delay of $1\frac{1}{4}$ seconds, releasing the harness, and leg restraint cords from the seat. Simultaneously, the drogues are detached from the top of the seat and the parachute pack and top of the face blind are also released. The drogues, however, remain connected to the apex of the parachute and withdraw it upwards. A 5,000 metre capsule can be fitted for flights over mountainous territory.

(b) A G-stop is also incorporated in the barostat mechanism so that, in ejections made at high aircraft speeds, the mechanism does not function until the speed of the seat has fallen to a safe value for parachute deployment. Ejection can be made from ground level upwards, provided that the aircraft's flight path and attitude are horizontal and that the speed is at least 90 knots. If the aircraft is descending or nose-down, more height will be required.

6 Hatch/seat connection

An interconnection between the seat-firing mechanism and each pilot's hatch enables the hatch to be jettisoned automatically when any firing handle is pulled. After operating the handle, there is a delay of one second before the ejection gun fires.

7 Leg restraint

Leg restraint cords are provided, to ensure that the legs are drawn back and held close to the seat pan during and after ejection. The cords pass through snubbing units below the front of the seat pan

and are then fastened to the cockpit floor with rivets which shear at a pull of 400 lb. The snubbing units allow the cords to pass freely down through the unit but prevent them passing upwards, except when released by the spring-loaded toggle at the front of each snubbing unit.

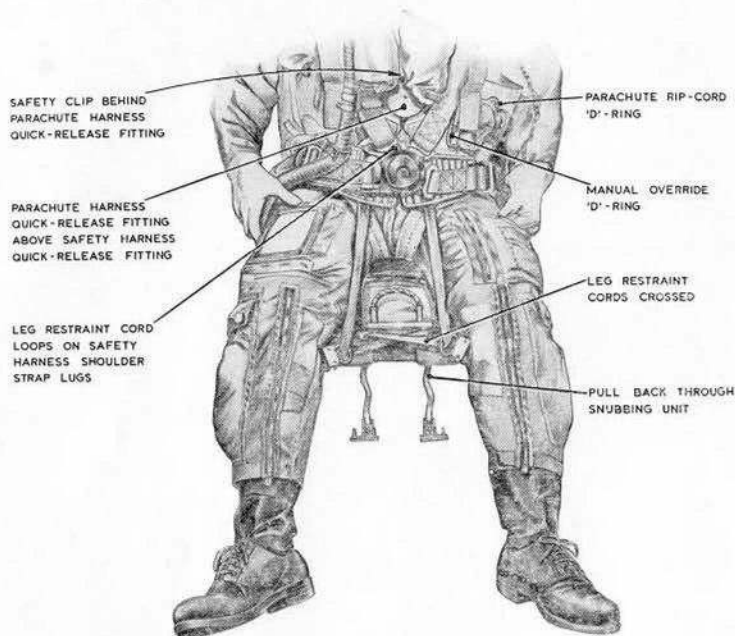


Fig. 3 Leg restraint

8 Manual separation

(a) To allow the occupant to release himself from the seat, should the automatic devices fail to operate, means of manual separation are embodied.

(b) The first (manual override) D-handle on the parachute waistbelt is pulled to disconnect the parachute from the drogue link line. This action also uncovers the second (rip-cord) D-handle.

(c) After operating the first D-handle, the seat harness may then be operated to enable the occupant to leave the seat. After leaving the seat, the parachute can be opened by pulling the rip-cord D-handle on the parachute harness.

Rear Crew Safety Equipment

9 Mask and helmet

A G-type helmet is worn with either a P1A or Q2A oxygen mask. These masks are of the chain-toggle, pressure-breathing type with a bayonet hose connection; they are identical apart from size. The mask should be tested before flight and the knurled screws adjusted so that there is no leakage under pressure. A lever on the front of the toggle harness is normally in the up position, should pressurisation failure occur, the lever is put to the down position, to clamp the mask more tightly on the face for pressure breathing. Post-Mod 3295 a mask hose assembly must be worn to connect to the aircraft assembly and the emergency oxygen hose.

10 Parachute assembly

(a) Pre-Mod. 3295

The rear crew members wear back-type parachutes Mk. 20 and personal survival pack type s. The parachutes have a barostat control which, when the static line is used, delays deployment of the parachute until below 13,000 feet. This can be overridden by the yellow and black knob on the left shoulder strap. The left shoulder strap also carries a red loop for operating the emergency oxygen and a snaphook for attachment to the static line. Four static lines are at the back of the AEO's seat.

(b) Post-Mod. 3295

(i) The Mk. 40 parachute is normally operated by the crew member attaching its static line to the hook on the appropriate swivel seat before leaving the aircraft. The Mk. 46 parachute static line remains connected throughout the flight. In either case when the occupant abandons the aircraft, the static line

arms the barostat unit, which delays deployment until either the escaper has fallen freely to 13,000 feet or if already below that height, for two seconds so as to be clear of the aircraft. This unit can be overridden by pulling the plastic sheathed tag attached to the parachute end of the static line. Static line operation should always be chosen as it automatically ensures deployment, even if the escaper is knocked out during the escape: the override is a safeguard in case of failure of the automatics, or of inability to hook on the static line for any reason. To override the automatics the handle on the crutch strap should be pulled.

(ii) The parachute embodies a demand EO set, normally initiated automatically by the static line. A knob on the crutch strap provides direct manual initiation if required.

11 Swivel seats—Mod. 3295

(a) Each rear crew member is provided with a swivel seat incorporating an assister cushion and a Mk. 40 or Mk. 46 parachute with a demand emergency oxygen set. The two navigators' seats swivel clockwise, the AEO's seat swivels anti-clockwise. The sixth crew seat is a non-swivelling seat fitted with an assister cushion. It must always be fitted facing rearwards.

(b) The seats are mounted on rails which allow them to be slid fore and aft as required. The seat rails are reinforced to take crash landing loads. Fore and aft movement of the seats is controlled by either a lever at the base of the rear of each seat (move to the right to unlock) or by the rearward movement (in relation to occupant) of the yellow/black lever on the left of the seat.

(c) Swivelling of the seats is controlled by either a lever at the top of the rear of each seat (move right to unlock) or by forward movement of the yellow/black lever on the left of the seat. These movements also unlock the valve of the seat back, which is spring-loaded, to a forward position necessary to clear obstacles when swivelling. Once either motion of the seat has commenced, the handle may be released and will spring back into its central posi-

tion to lock the seat again, when the seat has reached the opposite end of the travel.

(d) (i) The assister cushion is inflated by CO₂ stored in a bottle at the back of the seat at a pressure of 1,200 PSI. A pressure gauge is incorporated in the bottle.

(ii) The CO₂ is released to the cushion by pulling up a yellow/black knob, at the right of the seat, to the full extent of its travel. Additionally this action also releases the harness lap strap anchorages thereby freeing the occupant from the seat.

(e) The seat thigh supports can be adjusted for individual comfort by means of a star wheel mounted under the supports centrally.

(f) The yellow/black swivelling level incorporates a handle into which the individual parachute static line is clipped when leaving the seat prior to abandoning aircraft.

(g) When Mod. 3955, Part A, is embodied static line strong points are fitted as follows:

(i) Port seat point, on front face of desk.

(ii) Centre and starboard seat points, at front ends of centre seat lower rails.

(iii) Sixth crew seat points, at frame 63. The static lines (Mod. 3955, Part B) include mic/tel. lead, oxygen hose and electric wiring for the "crew gone" warning signals (see Chapter 14, Para. 10).

This permits the static lines to remain connected at all times.

Oxygen System

12 Description of oxygen system

(a) Oxygen is carried in ten 2,250-litre bottles. The bottles are all charged through a connection aft of the radome; the correct charging pressure is 1,800 PSI. Two pressure gauges on the AEO's panel BB show the pressure in each half of the system, indicating it as a fraction of the full charge contents. These gauges normally

read the same but a system of non-return valves and inter-connections enables one half of the system to supply oxygen should the other half fail. Mod. 3646 replaces the Mk. 17D regulators with Mk. 17F.

(b) From the oxygen bottles, the high pressure supply lines pass into the pressure cabin. Master valves, one for each side of the system, are below the pressure gauges.

(c) The supply is fed to four pressure-reducing valves, which reduce the pressure to 400 PSI. The medium pressure lines pass from each pressure-reducing valve to the regulators.

13 Oxygen regulators, general

(a) An oxygen regulator Mk. 17D or 17E (Mod. 2503—Mk. 1A only) is supplied for each crew member's normal station and one additional regulator is at the bomb-aimer's position. The 1st and 2nd pilots' regulators are at the forward ends of the port and starboard consoles. Mod. 3886 introduces a seventh Mk. 17F regulator at the sixth crew member's position. To operate the regulator the seat must be in the fully aft position.

(b) The regulator is designed to provide the following facilities:

(i) An oxygen supply in direct relation to the rate and strength of the user's respiration.

(ii) The correct ratio of air and oxygen according to cabin altitude. Above 32,000 feet cabin altitude, 100% oxygen is provided and 100% oxygen may be selected at any time.

(iii) A safety pressure, slightly higher than the normal delivery pressure, when cabin altitude exceeds 12,000 feet, and full pressurisation of the oxygen supply when the cabin altitude is between 39,000 feet and 56,000 feet.

(c) *Limitations*

The regulators will provide protection against loss of cabin pressure up to a cabin altitude of 50,000 feet, provided that a descent is started within 30 seconds of the pressure loss and that a cabin

altitude of 40,000 feet is reached within two minutes of the failure and that the oxygen contents have not fallen below $\frac{3}{8}$ of the total capacity.

14 Oxygen regulators, controls and indicators

(a) *Controls*

On the face of the regulator are three levers, whose operation and function is as follows:

(i) OXYGEN SUPPLY, ON/OFF lever. This lever controls the supply of oxygen to the regulator and must be ON at all times in flight.

(ii) NORMAL OXYGEN/100% OXYGEN lever. When in the normal position, this lever allows air to mix with the oxygen in suitable proportions, up to a cabin altitude of 32,000 feet. Above this altitude, the air inlet is closed and 100% oxygen is delivered in the mask. With the lever at 100% OXYGEN, the air inlet is closed regardless of the altitude; this position should always be used if toxic fumes are present.

(iii) An EMERGENCY three-position switch. When this is pushed in, in the central position, oxygen is supplied under pressure. The firmer the switch is pushed in, the greater the pressure. The mask can be adjusted so that no leaks are present. Movement of the switch to either side position causes oxygen to be delivered at a slight continuous pressure and should be so set if toxic fumes or anoxia are present.

(b) *Indicators*

(i) A gauge on the regulator shows the pressure of oxygen being delivered to the regulator and should indicate 200-400 PSI at all times; two gauges at the AEO's station show the main storage cylinder pressures as a fraction of the full charge contents.

(ii) A magnetic indicator on the regulator shows white when the user is breathing in. A repeater indicator is provided in the rear cabin for the bomb-aimer's regulator so that the other rear crew members can monitor this isolated station.



Fig. 4 Ejection seat occupied (1)

(c) *Dual oxygen feed coupling*

To provide a "walk around" facility for rear crew members from the main oxygen supply, and for use in the event of a regulator failure by any crew member a dual oxygen feed coupling has been introduced. It is stowed in a polythene bag on panel BD and consist of a dual feed coupling and flexible extension three feet in length. When in use two adjacent crew members can be supplied from any one oxygen connection except in the case of the visual bombing position.

15 Emergency oxygen

(a) *Pilot's emergency oxygen*

- (i) An emergency oxygen bottle is installed on the starboard beam of each ejection seat and feeds into the main oxygen tube.
- (ii) The emergency oxygen is operated automatically on ejection. It can also be selected manually by pulling up the knob on the inboard side of each seat. As the bottle is attached to the seat, emergency oxygen is not available after separation from the seat.

◀ (b) *Rear crew's emergency oxygen (pre-Mod. 3955)* ▶

An emergency oxygen bottle is in the top of each rear crew member's parachute pack and is operated automatically when the parachute static line is operated, or manually by a red loop on the left shoulder strap of the harness.

◀ (c) *Rear crew's emergency oxygen (post-Mod. 3955)*

- (i) The oxygen is passed through a demand regulator stowed in a pocket at the back of the parachute right half-belt. From the regulator, a breathing pressure hose is connected to the mask hose assembly when "strapping in". Safety pressure is provided from ground level to 40,000 feet and there is no Air Mix facility.
- (ii) The endurance of the set is approximately 10 minutes but, if it is accidentally operated when not connected to a mask worn by a crew member, the oxygen is rapidly exhausted in an attempt to maintain safety pressure. The manual over-ride knob is on the crutch strap.



Fig. 5 Ejection seat occupied (2)

Use of Aircrew Equipment Assemblies

16 Strapping-in procedure—pilots

- (a) When seated, connect the PSP lowering line to the life-saving waistcoat.
- (b) Secure the parachute harness and fit safety-clip to quick-release box.
- (c) Secure the seat harness and leg-restraint cords as follows:
 - (i) Fasten the leg-restraint garters below the knees with the D-rings to the rear (if not permanently embodied in the flying suit).
 - (ii) Fasten the lap straps of the seat harness, but do not tighten them.
 - (iii) Pass the left nylon cord through the right leg D-ring, under the right safety-harness lap strap and insert the right shoulder safety-harness eyepiece through the loop on the cord. Secure the shoulder safety-harness in the quick-release box.
 - (iv) Repeat for the other cord, passing the right cord through the left leg D-ring, under the left safety-harness lap strap and insert the left shoulder safety-harness eyepiece through the loop on the cord. Secure the safety-harness.
 - (v) Adjust the leg-restraint cords to give full rudder movement.
 - (vi) Sit well back in the seat and tighten the lap straps.
 - (vii) Take up all the slack in the shoulder straps but do not over-tighten them.
- (d) Connect the main oxygen and emergency oxygen supply tubes to the oxygen mask tube, ensuring that the emergency oxygen tube passes under the left shoulder strap. Attach the oxygen tube assembly locating chain to the LSW.
- (e) Connect the intercomm. lead.
- (f) Adjust the height of the seat.
- (g) Check that the face screen firing handle can be reached with both hands together.
- (h) Have all the safety-pins removed and stowed.

17 Strapping-in procedure—rear crew static seats

Prior to entering the seat, ensure that the safety-pins have been removed from the EO cylinder.

(a) When seated, connect the lanyard of the personal survival pack to the left webbing strap of the life-jacket, adjusting the length of the latter so that the quick-release fitting will lie clear below the harness lap strap when subsequently connected.

(b) Fasten the parachute harness:

(i) Pass the left half of the waist-belt over the life-jacket/survival pack lanyard connection.

(ii) Pass the right lap strap over the right thigh, thread it up through the right crutch loop and connect to the quick-release box on the waist-belt.

(iii) Connect the left lap strap similarly, ensuring that it passes over the survival pack lanyard.

(iv) Fasten the right shoulder strap into the quick-release box, ensuring that it lies under the stole of the life-jacket.

(v) Clip the hook of the right half of the waist-belt over the end fitting just connected.

(vi) Fasten the left shoulder strap into the quick-release box, ensuring that this strap passes over the "valley" between the cylinder and stole of the life-jacket.

The objectives are:

1 To leave the parachute static line hook, emergency oxygen control and override knob completely unobstructed.

2 To obscure the life-jacket cylinder red cap as little as as possible.

3 To trap as little as possible of the life-jacket stole.

(vii) Fit the safety-pin between the disc and the body of the quick-release box. Ensure that its webbing safe-tie is clear so that the clip can be rapidly disengaged.

(viii) Tighten the lap straps.

(c) Connect the quick-release couplings of the PSP to the parachute harness and tighten the restraining straps.

(d) Put on helmets and connect mask tube. Connect the emergency oxygen and attach the tube-locating chain to the life-jacket D-ring. Plug in the mic/tel lead.

(e) Fasten the safety-harness and adjust the seat position.

(f) Check the intercomm. and oxygen regulator.

18 Strapping-in procedure—rear crew swivel seats

▲ **WARNING:** Post-Mod. 3886 the sixth crew member's oxygen hose and static line must be routed between the back of his legs and his seat. Premature deployment of the parachute could occur within the cabin if an attempt to bale out was made with the hose routed in front of the legs. ▶

(a) Check the contents of the assister cushion bottle. The pressure should be 1,200 PSI. Insert the pip-pin.

(b) Remove the demand emergency oxygen pin.

(c) Slacken all the parachute straps fully and stow them in their stowages before getting in the seat.

(d) Check that the side harness straps of the personal survival pack are connected to the parachute harness.

(e) Connect the emergency oxygen supply to the oxygen mask hose.

(f) Adjust the parachute quick-release box in front of the body. Pass the thigh straps through the crutch loops and connect them to the quick-release box.

(g) Connect the shoulder straps to the quick-release box, ensuring that the hose assembly is beneath the right shoulder and leg straps. Tighten the harness.

(h) Connect the personal survival pack lowering line to the life-jacket.

(j) Connect the oxygen mask hose to the aircraft assembly and make the mic/tel. connection.

(k) Connect the static line to the aircraft hose assembly (Pre-Mod. 3955 to the swivelling lever).

- (l) Fasten the seat lap strap.
- (m) Check the seat swivelling and sliding actions and make sure that the personal survival pack lowering line does not foul on any portion of the seat.
- (n) Put on the helmet and connect the mask tube to the mask hose.
- (o) Connect the mic/tel. lead.
- (p) Check the intercomm. and oxygen.

19 Normal exit procedure

(a) Pilots

- (i) Remove helmet and mask, disconnecting mask tube and mic/tel lead.
- (ii) Remove safety clip from quick-release box and undo harness.
- (iii) Disconnect dinghy lanyard.
- (iv) Disconnect the leg restraint cords.
- (v) Move out of the seat, seeing that the leg restraint cords pass through the garter D-rings.

(b) Rear crew members (static seats)

- (i) Remove helmet and mask, disconnecting mask tube and mic/tel lead.
- (ii) Disconnect safety harness and parachute harness.
- (iii) Disconnect dinghy lanyard.
- (iv) Disconnect emergency oxygen.
- (v) Leave seat.

(c) Rear crew members (swivel seats)

- (i) Remove the helmet and mask, disconnecting the mask tube and mic-tel lead.
- (ii) Disconnect the safety harness and parachute harness.
- (iii) Disconnect the emergency oxygen supply.
- (iv) Slacken the parachute straps and stow them in their stowages.

- (v) Disconnect the personal survival pack lanyard.
- (vi) Disconnect the static line.
- (vii) Disconnect the mask hose assembly from the aircraft hose assembly, placing the aircraft assembly in its stowage.
- (viii) Replace the emergency oxygen safety pin.
- (ix) Remove the assister cushion pip pin.

20 Pressurisation failure

If the cabin pressure fails, each crew member should immediately depress the lever on the mask toggle harness. This will clamp the mask tightly against the face to prevent leakage of oxygen. If the cabin altitude is above 40,000 feet, a descent must be made to 40,000 feet cabin altitude within two minutes of the failure, with a subsequent descent to below 20,000 feet, to avoid the effects of decompression sickness.

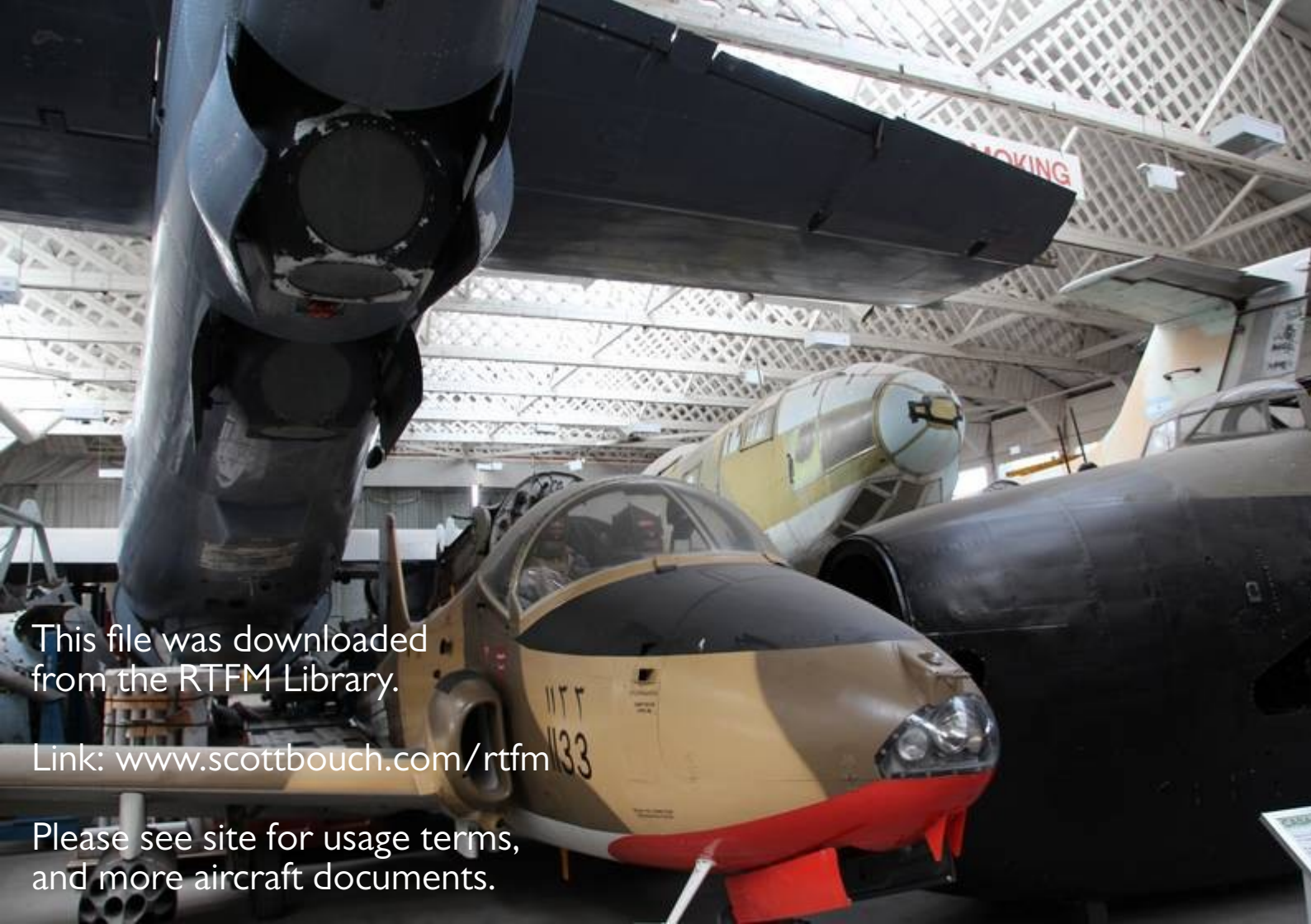
21 Regulator failure

(a) Pilots

If a pilot's regulator fails above 10,000 feet cabin altitude, he should immediately select emergency oxygen, by pulling up the handle beside his seat. The regulator should be switched off. Post-Mod. 3955 he should transfer to any other available regulator. A spare mask hose assembly should be carried for this purpose. The emergency oxygen is only sufficient for 10 minutes and descent should therefore be made to an altitude where oxygen is not required. When this altitude has been reached, if the main regulator has been on 100% OXYGEN, switch over to NORMAL so that cabin air can be freely breathed, while maintaining mic/tel, etc. ▶

(b) Crew members

If a crew member's regulator fails, he can transfer to the dual oxygen feed coupling or, post-Mod. 3955, to any other available regulator. It is not operationally practicable to use the emergency oxygen set except when abandoning the aircraft or whilst reducing to a safe altitude. ▶



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