Memo 2: Operational Procedures

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Last revised: 2025-06-09

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1. SARPS

Standards and recommended practices, Annex 6 “Operation of Aircraft” Part 2. Ensures consistent safety for passengers regardless of crew experience or standards. Compliance is the responsibility of both the A/C owner and the PIC.

2. Definitions

- “aerial work”: an aircraft being used in the air for commercial reasons (e.g. agriculture, photography, surveying, etc.), excluding the transport of air passengers, cargo and mail.
- “commercial air transport operation”: an aircraft being used in the air for transport of passengers, cargo or mail.
- “dangerous goods”: articles or substances posting a risk to health, property or the environment
- “flight plan”: specified information provided to ATSUs relating to a intended flight or portion of flight
- “extended flight over water”: a flight over water (away from land suitable for an emergency landing) for more than 50nm or 30 minutes at normal cruising speed, whichever is shorter
- “flight time”: the total time from the moment an A/C first moves for the purpose of taking off until it comes to rest at the end of a flight.
- “general aviation operation”: an A/C operation other than a commercial air tranport operation or an aerial work operation.
- “IMC”: meterological conditions (visibility, distance frrom cloud and ceiling) less than the minima for VMC.
- “night”: the time between the end of civil twilight and the beginning of morning civil twilight (or other period as specified by the authority).
- “operational flight plan”: the operators plan for the safe conduct of the flight based on performance, operating limits, en-route conditions and route.
- “operations manual”: a manual containing procedures, instructions and guidance for use by operational personnel during their duties.
- “pilot in command”: the pilot designated by the operator/owner as being in command and charged with the safe conduct of the flight.
- “psychoactive substances”: alcohol, opioids, cnanabinoids, sedatives and hypnotics, cocaine, other psychostimulants, hallucinogens and volatile solvents (coffee and tobacco excluded).
- “VMC”: meterological conditions (visibility, distance frrom cloud and ceiling) equal or better than the specified minima.

3. Air Operations

- Split up depending on level of crew competence and type of operation, e.g. CAT (Commercial Air Transport), SPO (Special Operations), NCO (Non-commercial, non-complex A/C), NCC (Non-commercial, complex A/C)
- "ELA1": European Light Aircraft
  - an aeroplane or sailplane with a MTOM of 1200kg or less, not complex, or;
  - a balloon with a maximum design lifting hot air of not more than $3400m^3$, gas $1050m^3$ or $300m^3$ for tethered gas balloons.
- "ELA2" European Light Aircraft
  - an aeroplane or sailplane with a MTOM of 2000kg or less, not complex,
  - a balloon, or;
  - a very light rotorcraft with a MTOM not exceeding 600kg, without more than 2 occupants, not powered by turbine or rocket, restricted to day VFR.
- PART-NCO
  - non commercial, non-complex aircraft
- PART-SPO
  - any complex aircraft, non-commercial is also extended in PART-NCO.SPEC
  - any operation other than CAT (see Section 2) where the aircraft is used for specialised activities
  - some activities may be "High Risk" and subject to prior authorisation
  - operators conducting non-commercial specialised operations may comply with PART-NCO *and* PART-NCO.SPEC
- PART-NCO.SPEC
  - Applies to any specialised activity in non-complex motor-powered PART-21 aircraft, including: helicopter sling loads, human external cargo, parachute operations, etc.
  - Compliance with relevant elements of PART-NCO is still required
  - If the activity does fall within non-commercial SPO, teh PIC shall comply with all the assigned requirements:
    - conducting a risk assessment
    - using a checklist based on the risk assessment
      - crew duties and task specialist duties shall also be specified
    - safety briefing
      - also for task speciialists on:
        - emergency equipment and procedures
        - operational procedures associated with the specialised task

4. UK ANO

- General Aviation Operations for non-PART-21 A/C in any capacity other than CAT and aerial work (see Section 2 for definitions)
- ANO article 76 and 77 definies operating minima and equipment requirements for private aircraft

5. Aircraft and Airworthiness

- Flight Manual and Limitations
  - Each manufacturer shall provide information and data via a POH/AFM
  - The POH/AFM must be specific to the individual aircraft by serial number
  - The POH/AFM must be referred to in the C of A and forms a part of the C of A.
  - A state may issue POH/AFM amendments as it sees fit
  - Pertinent information shall be placed in placards in the cockpit
    - Placards are detailed in the POH/AFM, which shall show the location of the placards as well.
  - Operating the A/C outside of the performance limits specified in the POH/AFM will invalidate the C of A and insurance.

- Journey log book
  - Required for all Part-21 A/C
  - Should contain:
    - a/c nationality and registration
    - date
    - crew member names and duty assignments
    - departure and arrival points and times
    - purpose of flight
    - observations regarding the flight
    - signature of the PIC

- Weight and balance schedule
  - Issued for individual a/c
  - Shows:
    - aircraft weight
    - the distribution of weight (i.e. centre of gravity)
    - the "stations" of the aircraft where load may vary (i.e. seats, baggage areas, fuel tanks)
  - A/C get heavier with age, but re-weighing is only required after:
    - respray
    - internal equipment change
    - major modification
  - Once a new W&B schedule is issued, the old one must be retained for 6 months

- Noise Certificate
  - a details the level of noise produced
  - required by law in some states (e.g. Germany)

- Insurance
  - required by law for 3rd party cover
  - some airfields may require specific levels of insurance (e.g. Crown Indemnity at military airfields)

- Additional flight requirements

  - Requirements for all flights: († denotes items not required for national flights in the UK)
    - Flight Manual
    - C of R†
    - C of A†
    - Noise Certificate†

  - Aircraft Radio License†
  - Journey Log Book (A/C)†
  - Insurance†
  - Flight Plan
  - Route charts for the flight
  - MEL
  - Interception procedures
  - ELT or PLB
  - First Aid Kit
  - Portable Fire Extinguisher
  - seat belt for each seat used by persons over 2 years of age
  - spare fuses
  - active CO detector (for piston aircraft, except a few exceptions)

- For flights over water in all SEP A/C beyond gliding distance from shore or taking off/landing over water, also:
  - A life jacket for each person on board, or;
  - equivalent individual floatation device for each person on board younger than 2 years.
  - It should be worn or stored in a position that is readily accessible from the respective seat.

- For extended flights over water (see Section 2 for definition):
  - The PIC shall determine suitable equipment based on the risks of survival of the occupants:
    - equipment for making distress signals
    - life-rafts to carry all persons on board
    - life-saving equipment to sustain life.

- For day VFR:
  - Airspeed indicator
  - Altimiter
  - Compass
  - Timepiece
  - Slip indicator (recommended but not required)

- For IFR, day VFR requirements and:
  - Turn and slip (which can be included in an EFIS)
  - Attitude indicator (which can be included in an EFIS if safeguarded against total failure)
  - Directional indicator (which can be included in an EFIS if safeguarded against total failure)
  - Gyro power source indicator
  - OAT
  - VSI
  - A way to measure and display time in hours, minutes and seconds.

- For Night VFR, day VFR requirements and:
  - Turn and slip (which can be included in an EFIS)
  - Attitude indicator (which can be included in an EFIS if safeguarded against total failure)
  - Directional indicator (which can be included in an EFIS if safeguarded against total failure)
  - Gyro power source indicator
  - OAT
  - A way to measure and display time in hours, minutes and seconds.
  - Navigation lights
  - Landing light

    - Illumination for all flight instruments and equipment used by crew
    - Lights in all passenger compartments
    - Independent portable light for each crew member station
  - Radio equipment
    - Capable of communicating on 121.5 MHz
    - For IFR flight, controlled VFR, or extended flight over water (see Section 2 for definition), one radio is required.
  - Navigation equipment
    - A/C shall be provided with navigation equipment which will enable it to proceed in accordance with the flight plan and requirements of ATSUs
- Aircraft Log Book
  - All maintenance tasks must be recorded
  - Including any tasks undertaken by the pilot where they are legally permitted to do so
- Certificate of Release to Service
  - Valid for 6 months or 50 hours, whichever is shorter
- Maintenance
  - Undertaken by a licensed engineer
  - Have to have a duplicate sign-off

6. General Operations

- PIC Responsibilities
  - safety of A/C, crew, pax and cargo
  - safe operation of A/C with required procedures, checklists, etc.
  - flight planning
  - ensuring A/C and crew documents are legal and in order
- PIC Authorities
  - may refuse carriage of people, baggage or cargo
  - may deviate from a rule or procedure in an emergency, which may require a report submission to the state concerned if they require it
- PIC Compliance
  - shall comply with all laws, regulations and procedures of the states where operations are conducted
  - shall be familiar with the laws, regulations and procedures pertinent to the flight
- Dangerous Goods
  - Carriage only with CAA approval
  - Portable Electronic Devices
    - The PIC shall not permit any person to use a PED that could adversely affect the performance of A/C systems and equipment

7. Pre-Flight Operations

- The PIC shall:
  - ensure a flight will not commence if any crew are unwell (apply IMSAFE)
  - ensure a flight will not commence unless that the following required for the flight are available and adequate:
    - ground/water facilities
    - communication facilities
    - navigational aids
  - ensure that the A/C is prepared for the flight about to be undertaken
    - the A/C is inspected, including all documentation and equipment servicable and free from ice
    - fuel and oil loaded within limitations
    - legally required equipment is on board

- Aerodromes
  - Some aerodromes require PPR
  - Permission from the person in charge is required to take persons or vehicles onto any part of the aerodrome
  - Taxying on the manoeuvring area is allowed only by a qualified person, fully competent and able to use RT and conform to procedures
  - When selecting an aerodrome operating minima, consider:
    - capabilities
    - competence and experience
    - runway dimensions and characteristics
    - ground aid adequacy and performance
    - obstacles
    - weather
    - etc.
  - The minima for a specific approach and landing procedure shall only be used if:
    - the ground equipment is operative
    - the A/C systems required are operative
    - the required performance criteria are met
    - the pilot is suitably qualified.
  - For visual approach, the RVR should not be less than 800m

- Flight Preparation
  - airspace (including temporary!)
  - hazards
  - NOTAMs
  - flight plans might need to be submitted!
    - an alternate aerodrome is required for any IFR flight where the destination is not under VMC for at least an hour before and after the ETA
  - fuel/oil (legal minimums specified)
    - day VFR: flight + (divert + 5%, recommended but not legally required) + 30 minutes at normal cruising altitude
    - night VFR: flight + (divert + 5%, recommended but not legally required) + 45 minutes at normal cruising altitude

  - refuelling of AVGAS shall not occur whilst passengers are embarking, on board or disembarking
  - refuelling of other types of fuel shall not occur whilst passengers are embarking, on board or disembarking unless it is attended by qualified personnel ready to initiate and direct an evacuation of the A/C
- baggage
  - securely stowed
- passenger briefing
  - passengers must be ready to disclose their real weight and any relevant medical facts
  - brief them on airfield safety
  - familiarise with the location and usage of seat belts and emergency equipment
  - action in the event of feeling unwell (feet flat on the floor, location and availability of sick bags)
- check lists
  - ... are required for all aircraft

8. Regular Flight Operations

- Definitions:
  - TORA: Take-off Run Available
  - TODA: Take-off Distance Available (TORA + Clearway (before 50ft obstacle))
  - EDA: Emergency Distance Available (TORA + Stopway)
  - ASDA: Accelerate-Stop Distance Available (EDA synonym)
  - QDM: Runway Magnetic Heading

- Simulated Situations in Flight
  - The PIC shall not simulate when carrying pax or cargo:
    - situations that require abnormal or emergency procedures
    - flight in IMC
  - except for the purposes of training with student/s

- Seatbelts and safety harnesses
  - should be worn by all flight crew during take off and landing phases or when at their stations

- Noise abatement
  - Contained within the AIP
  - Applies to all aircraft, except where it might affect safety
  - A recommendation only, not mandatory

- Runway condition reports
  - The runway is split into 3 sections
  - Each section is rated from the following conditions:
    - Dry
    - Wet: covered by visible dampness <=3mm
    - Slippery wet: wet with degraded friction
    - Contaminated: runway section covered by one or more substances from the runway surface condition descriptors
    - Flooded: extensive patches of standing water

  - Compacted snow: Snow that has been compacted such that a landing wheel will not significantly compact the snow further
  - Dry snow: snow from which a snowball cannot be made
  - Frost: Ice crystals on the surface from airbourne moisture making contact with the surface as it is below freezing
  - Ice: water or compacted snow that has transitioned into ice in cold and dry conditions
  - Slush: Snow that is water saturated
  - Wet ice: Ice with water on top of it, or melting ice
  - Wet snow: snow that contains enough water to make a snowball when compacted, but water will not be squeezed out (which would make it slush)
- A runway is entirely contaminated when a significant portion of the runway surface is covered by one or more of the above conditions

- Braking effectiveness
  - Measured as a coefficient of friction:
  -

Description	Coefficient of Friction
Good	≥ 0.4
Medium-Good	$(0.35, 0.4)$
Medium	$[0.3, 0.35]$
Medium-Poor	$(0.25, 0.3)$
Poor	≤ 0.25

  - Dynamic aquaplaning occurs when tyres ride on a film of water
    - The minimum aquaplaning speed can be calculated with Home's formula: $v_{\text{min aquaplaning}} = 9 \cdot \sqrt{\text{tyre pressure in psi}}$
  - Viscous aquaplaning occurs on abnormally smooth surfaces
    - Can occur at any speed and pressure
  - Reverted rubber aquaplaning occurs when the heat of friction from a locked wheel melt the rubber, the surface moisture heats into steam, and the rubber reshapes around the steam bubble, sealing the centre of the tyre above the ground

9. Wake Turbulence

- Wake turbulence occurs whilst the aerofoil produces lift (i.e. from v_r until the nose wheel touches down after landing)
- Vortex wake dissipates horizontally from the wing tips
- Wake turbulence descends at between 500 and 1000 fpm
- Wake turbulence extends up to 5 miles behind an aircraft
- Wake turbulence is increased by:
  - heavier aircraft
  - high AoA
  - low speeds
  - clean (flaps up) configuration
  - hovering helicopters (produces vortex within 3 rotor diameters)

- Approach separation minima apply when an aircraft is operating behind or crossing behind another aircraft, or both A/C are using the same runway, or parallel runways closer than 760m.

Leading A/C	**ICAO (nm)**	**UK (nm)**
Super	8	8
Heavy	6	7
Upper Medium	5	6
Lower Medium	5	5
Small	N/A	4

- Departure separation minima apply when an aircraft is operating behind or crossing behind another aircraft, or both A/C are using the same runway, or parallel runways closer than 760m.
  - 2 minutes if departing from the same point on the runway
  - 3 minutes if departing on a point further along the runway
- To avoid wake turbulence on approach, you can:
  - land beyond the point of the nosewheel touchdown of a preceding landing heavier a/c, provided the runway is sufficiently long
  - land before the point of rotation of a preceding departing heavier a/c

10. Wind Shear

- When wind speed or direction significantly change
  - can be used for fuel conservation or reduction in flight time if used wisely
- Microbursts are highly localised ($< 4\ \mathrm{km}$) and dangerous downdraughts
  - If encountered: wings level, full power, fly straight ahead
  - When the downdraught from a microburst meets the ground, it spreads out creating windshear conditions
- Other windshear conditions:
  - passing of a weather front
  - virga (precipitation falling from a cloud but evapourating before it reaches the surface)
  - thunderstorms
  - roll cloud (near thunderstorms of the lee side of a mountain or hill)
  - inversions

11. Emergencies and Occurrence Handling

- Radio Failure
  - certain airfields have specified procedures
  - generally, when outside controlled airspace:
    - do not enter unless clearance has already been given (unless it was SVFR clearance)
    - head for the nearest suitable airfield and land
  - generally, when inside controlled airspace:
    - continue as cleared and land at the nearest suitable airfield

  - squawk 7600 A+C and transmit blind on the correct frequency
  - once at the intended airfield:
    - look for light signals
    - join overhead
    - keep an extra careful lookout
    - if in doubt, perform a low go around with lights flashing on/off irregularly

- Fuel state R/T calls

  Minimum fuel during flight, the pilot calculates that the destination will be reached with only the minimum fuel remaining (i.e. 30 mins day VFR, 45 mins night VFR or IFR), then the pilot must declare "G-ABCD, Minimuim fuel"

  Fuel emergency during flight, the pilot calculates that the destination will be reached with less than the minimum fuel remaining (i.e. 30 mins day VFR, 45 mins night VFR or IFR), then the pilot must declare "Mayday, mayday, mayday, G-ABCD, fuel emergency"

- Fire on engine start-up
  - Officially an "intake manifold fire"
  - Normally as a result of over-priming
  - Pilot action:
    - keep cranking the engine
    - mixture lean
    - throttle fully open
    - fuel switch off
    - prepare for evacuation

- Engine fire in flight
  - Could be caused by fuel, electrics or oil
  - Pilot action:
    - Throttle closed
    - Mixture lean
    - Close cabin heat
    - Adopt best glide speed
    - Side slip to avoid smoke and flames in the cockpit
    - Execute a forced landing

- Cockpit fire in flight
  - Most often caused by electrics
  - Pilot action:
    - inform ATC
    - all electrical equipment off (including masters)
    - cabin heat off
    - land at nearest aerodrome
    - *if flames are visible*:
      - use an extinguisher
      - ventilate cockpit immediately
      - land ASAP

- Forced landing:
  - Pick a field
  - Get on the ground and run into a hedge rather than flying into a hedge
  - Aim the nose to safety, hit the wings into walls if needed

    - **Always land gear up**
    - Go under any wires

- Engine failure in flight:
    - If possible, figure out cause and attempt a restart
    - Otherwise, distress call and forced landing
    - Pilot action:
        - Carb heat hot
        - Select a field to land
        - Check fuel system
        - Check mags
        - Check throttle
        - Attempt restart
        - *If no restart*:
            - Distress call
            - Close throttle
            - Mixture lean
            - Mags off
            - Masters off
            - Brief pax for forced landing (if time)

- General evacuation procedure:
    - stop on the runway
    - shut down everything
    - evacuate pax using all available exits (upwind of fire only if needed)
    - ensure pax move upwind of the A/C after evacuation

- Ditching
    - Wear life jackets at all times over water
    - Don life jackets outside the a/c
    - Inflate life jackets outside the a/c, before entering the water if possible
    - Life rafts should be near a door
    - Distress call (and 7700 if no squawk issued)
    - Land perpendicular to the swell in light wind
    - Land into wind in strong wind (but beware of swell, try to land after a wave)
    - The biggest risk is hypothermia, make sure someone knows you're ditching!
    - Perform the crash drill early:
        - Stow all loose objects, including headsets, wires, glasses, etc
        - Harnesses tight until they hurt
        - Open windows and hatches slightly
        - Gear up if possible
        - Remind pax of the brace position
    - Hold off and touch down at stall warner
    - Wait until things have settled if you nose over
    - High wing A/C:
        - wait until the cabin floods before trying to get out
        - dive below the wing (+ flaps) and get out behind the wing
        - try to climb on the wing surface and inflate life jackets
    - Low wing A/C:
        - open hatches and get on top of the wing

    - inflate life jackets and rafts
  - Stay together in the water
  - Use the chain swim technique to move away from a sinking A/C
  - Stay ***close*** to conserve body heat

- Precautionary landing
  - any landing that is planned due to an unexpected situation
  - for example, as a result of fuel shortage, worsening weather, pilot illness, etc.

- CO poisoning
  - Turn cabin heating off
  - Ventilate the cockpit
  - Land ASAP

- ICAO definitions
  - Incident: an occurence which affects or could affect safety
  - Serious Incident: an incident where an accident nearly occurred
  - Serious Injury: burns, fractures, lacerations, internal injury, exposure to harmful substances
  - Accident (reportable): from the time of boarding to the time of leaving, the following are reportable:
    - death or serious injury, excluding natural causes and self-infliction
    - aircraft incurs damage or structural failure, except engine failure or damage to cowls, props, wingtips, antennas, tyres, brakes, fairings or small holes and dents
    - the aircraft is missing or inaccessible
    - all reportable to the AAIB (and the police in the UK)

12. Other Operations

- Hand swinging a properllor
  - Leave it to a professional!
  - Also requires a competent individual in the cockpit
  - Requires knowledge of priming, the engine and a feel for lean or flooded engines