CIVIL AVIATION PUBLICATION

CAP 30

POLAR ROUTE OPERATIONS

CONTENTS

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CONTENTS

Section	Title	Page No.
1.	General	1
1.1	Purpose	1
1.2	Abbreviations	1
1.3	References	1
2.	Operational Considerations	1
2.1	Fuel Freeze Strategy and Monitoring	1
2.2	Navigation	2
2.3	Communication	2
2.4	Radiation	3
2.5	In-Flight Diversion	3
2.6	Designation of en-route Alternate Airports	3
2.7	Space Weather Considerations	4
3.	Recovery Plan	4
4.	Equipment to be Carried	5
4.1	Additional Equipment	5
4.2	Aircraft Minimum Equipment List Considerations	5
5.	Training	5
6	Operational Plan	6
6.1	General	6
6.2	Objective	6
6.3	Approach	6
6.4	Content of the Operational Plan	7
6.4.1	General	7
6.4.2	Rostering and Scheduling	7
6.4.3	Crew Complement, Qualifications and Training	7
7.	Application and Certification Process	8
7.1	Application	8
7.2	Document Review Phase	8
7.3	Demonstration and Validation Phase	8
7.3.1	Demonstration Phase	8
7.3.2	Validation Phase	9
7.4	Certification Process	9
8.	Monitoring and Oversight	9
8.1	Management Responsibility	9
8.2	Flight Operations Responsibility	10
8.3	Flight Crew Feedback and Operational Review	10

1. GENERAL

1.1 Purpose

The purpose of this CAP is to indicate the important operational issues which are relevant to safe flight operations in designated polar areas of substantially uninhabited land where polar conditions are likely to be met and to provide guidance to operators to ensure the safe and efficient conduct of these flights.

This CAP provides policy and guidance material for operators, who propose to conduct flight operations into and across the polar areas of the globe North of 78º N latitude or South of 60ºS.

[Unless the aircraft can meet the maximum distance from an adequate aerodrome without an EDTO approval under CAR OPS 1.245, a Commercial Air Transport operator, intending to carry out operations into the polar areas, must have the appropriate EDTO approval from the CAA.]

1.2 Abbreviations

AOC	Air Operator Certificate
EDTO	Extended Diversion Time Operations
ETP	Equal Time Point
FMS	Flight Management System
GPS	Global Positioning System
HF	High Frequency Radio
MEL	Minimum Equipment List
PNR	Point of No Return
QFE	Q-code for atmospheric pressure at an aerodrome elevation (or at RWY threshold)
SATCOM	Satellite Communication
VHF	Very High Frequency Radio
APU	Auxiliary Power Unit

1.3 References

- FAA Order 8900.1 Flight Standard Information Management System (FSIMS)
- FAA AC 120-61B In-Flight Radiation Exposure
- Boeing AERO series Publication on Polar Route Navigation
- Airport Safety and Operational Assessment (from Boeing)

2. OPERATIONAL CONSIDERATIONS

2.1 Fuel Freeze Strategy and Monitoring

The operator must develop a fuel freeze strategy and monitoring programme to be used in lieu of the standard minimum fuel freeze temperatures. This fuel freeze analysis and monitoring programme for the aeroplane fuel load is to be submitted as part of the approval application.

The fuel freeze strategy and monitoring programme should include procedures for the coordination between maintenance, dispatch and assigned flight crew to convey the determined fuel freeze temperature of the fuel load on board the aeroplane.

Temperatures at normal cruise altitudes through the polar areas can be measurably colder than at lower latitudes for obvious reasons. An operator needs to have in place a means to prepare for and monitor the fuel tank temperatures throughout any long flight, but especially when flying through these higher latitudes.

During the pre-flight preparation stage, dispatch can provide analyses of projected fuel temperatures for crew to review. There are several different formats which can be provided including waypoint by waypoint projected fuel temperatures (Fuel Temperature Prediction Programme) and calculations made from measurements taken at various times during refuelling to establish on board fuel freeze points.

During their polar areas route training, pilots will need to be reminded of the need to have contingency plans in place in the event fuel temperature degrades more than was planned. Changes in route, altitude or Mach may be required to increase fuel temperature to safe limits.

Since fuel specifications may vary, operators must ensure that their planning includes reference to the appropriate specification and that operating crews are correctly informed of their fuel temperature limits for each flight. With mixed fuels in the aircraft tanks, for example, the temperature limits for the most restrictive fuel type must be observed if not allowed for in the calculation of the estimated on board fuel freeze point.

2.2 Navigation

The operator should provide information and procedures with regard to the use of Magnetic and True directional references for navigation through the area of magnetic unreliability (AMU) and near or over the True Geographical Pole.

Modern long range aircraft Flight Management Systems (FMS) are designed to operate in the polar areas and cockpit displays are switched either automatically or manually upon entering the area of compass unreliability.

2.3 Communication

The operator must have effective voice communications and/or data link capability for all portions of the flight route. Company communications may be accomplished using HF voice, HF data link, satellite communication (SATCOM) voice or SATCOM data link. Because of the limitations of VHF and satellite-based voice communications, ATC communications will probably require high frequency (HF) voice over portions of these routes and SATCOM may not be available for short periods during flights over the Poles.

Communication capability utilising HF radios may be affected during periods of solar flare activity so the operator should consider predicted solar flare activity and its effect on communications for each flight that is dispatched for operations into these areas.

2.4 Radiation

The operator should regularly monitor space weather activity and provide Solar Radiation, Geomagnetic Storm and Radio Blackout forecasts to the crew. A clear dispatch policy guideline on Solar Radiation, Geomagnetic Storm and Radio Blackout should also be in place.

Note: Refer to FAA AC 120-61B – In-Flight Radiation Exposure for further information on radiation.

2.5 In-Flight Diversion

Apart from engine failure, an in-flight decision to divert could be caused by events including but not confined to:

(a) medical alerts;

(b) depressurisation;

(c) hydraulic failure; and

(d) smoke warning in cargo-hold, in-flight entertainment system or Avionics.

An in-flight diversion within the Polar Region should take into account remoteness of the region, weather conditions as well as limited supporting facilities. In this regard the operator should develop appropriate procedures and processes to facilitate decision making for in-flight diversion.

Guidelines on medical emergencies, especially when no medical personnel are available on board, has to be provided.

2.6 Designation of En-Route Alternate Airports

The operator must designate a set of alternate airports, regardless of their distance from the planned route, such that one or more can reasonably be expected to be available in a variety of weather conditions, to support a diversion.

The aeroplane must be able to make a safe landing at the selected diversion airport and it should be able to manoeuvre off the runway after landing. The operating crew should be made aware of the need, conditions permitting, to vacate the runway after landing. The airport should also have the capability to remove the aeroplane from the runway should it be unable to vacate the runway, so as not to block the operation of a recovery aircraft.

[When selecting these en-route alternate airports, the following issues must also be considered;

(a) maximum distance from an adequate aerodrome with or without an EDTO approval;]

(b) Airports need to be selected for their availability and suitability to handle varying operational and personnel related situations;

(c) Several must be chosen to allow for the possibility of closures such as could occur with bad weather or airport equipment failure;

(d) Airport construction and design items such as surface Load/Pavement Classification Number (LCN/PCN) and airfield manoeuvre layout must be suitable for the aircraft type to be used. The aeroplane must be able to make a safe landing and manoeuvre off the runway at the selected en-route alternate airport.

(e) The airport should also have the capability to remove disabled aeroplane following landing, so as not to block the operation of a recovery aircraft.

(f) Airport infrastructure must allow for safe and satisfactory passenger handling during possible adverse weather conditions, including facilities for deplaning, food and water, shelter with air-conditioning, medical aid, the physiological needs of passengers and crew, transportation and communications, for the duration of the stay until safe evacuation.

2.7 Space Weather Considerations

Operators planning to transit the polar areas must familiarize their flight crews and dispatch personnel in the effects of Space Weather. Primarily this involves information on cosmic radiation emanating from the sun and the increased effect it has in the shallower arctic atmosphere and magnetic field. Solar flares provide the most extreme forms of this radiation, and if present to any great level, can force the re-routing or cancelation of a service.

The operator must ensure that there is an alerting system in place if normal thresholds are crossed for: Geomagnetic Radiation affects, Global Positioning System (GPS), Solar Radiation (affects human physiology), and Electromagnetic Radiation (affects HF communications).

During the course of a flight, operations control needs to monitor the radiation hazard and update crew to allow for speed, route or altitude changes as any serious radiation changes might require.

Operators are to ensure exposure limits are adhered to and documentation of radiation exposure is kept.

3. RECOVERY PLAN

A very important aspect of an unplanned diversion in the Polar Regions is the recovery plan. The operator:

(a) [should be able to adequately document their ability to launch and conduct the recovery plan during initial application for Polar route approval; and]

(b) must conduct annual audit of his recovery plan for accuracy and completeness

Safe extraction of passengers and crew members should be planned to be completed without any delay and within a reasonable timeframe of 12 to 48 hours.

The plan needs to address the full logistics of both passenger and crew handling, including, provisions for their complete physiological, medical and communications requirement, as well as plans for their transport from that airport onward in order to safely and expeditiously extract passengers and crew.

[The operator should be able to document the recovery plan as part of an emergency response plan conducted under the SMS.]

After the immediate concerns are addressed, the plan shall address provisions for initiating extraction procedures for passengers, crew and the aircraft.

4. EQUIPMENT TO BE CARRIED

4.1 Additional Equipment

The operator should consider the circumstances described in the above paragraphs in their safety risk assessment and determine an appropriate list of equipment to be carried. It is expected that the additional equipment would include;

(a) at least two cold weather anti-exposure suits in order for the crew members to carry out activities at an aerodrome during severe climatic conditions in a polar area.

(b) except for all-cargo operations, an expanded medical kit including an automated external defibrillator (AED).

(c) a means to melt snow and for sleeping bags to be carried for use by 1/3 of those on board with sufficient blankets for the remainder.

4.2 Aircraft Minimum Equipment List (MEL) Considerations

An operator must review its MEL for consideration of the dispatch availability of the following systems/equipment:

(a) Fuel quantity indicating system (FQIS), including the fuel tank temperature indicating system;

(b) [APU (when the APU is necessary for an airplane to comply with Commercial Air Transport EDTO requirements), including electrical and pneumatic supply to its designed capability;]

(c) Auto-throttle system;

(d) Communication systems relied on by the flight crew to satisfy the requirement for communication capability; and

(e) FMS guidance systems.

5. TRAINING

The operator should address the following training requirements in the training programme:

(a) QFE/ QNH and meter/feet conversions (required for flight crew and dispatch);

(b) Fuel freeze (training for maintenance, dispatch, and flight crew);

(c) Route-specific training on weather patterns;

(d) Relevant aircraft system limitations e.g. fuel temperature limits;

(e) Maintenance control role in providing aeroplane systems capability

(f) information to dispatch and flight crew, to aid pilot-in-command in diversion decision-making;

(g) Crew training on the use of cold weather anti-exposure suits;

(h) Dispatch and crew considerations during solar flare activity; and

(i) Training of flight crew and dispatcher for role in the operator's passenger recovery plan.

6. OPERATIONAL PLAN

6.1 General

An operational plan must be developed in order to achieve an acceptable level of safety based on both proper planning and established historical records and procedures.

6.2 Objective

The objective is to determine and provide the best strategies for training, pre-flight planning, in-flight operations, and operations control to ensure a safe and efficient Polar operation.

6.3 Approach

An operator planning to conduct Polar Operations must understand that the world's polar areas present an extremely harsh and hostile environment to be dealt with should it become necessary.

With this in mind, the operator needs to take an expansive approach to reviewing all operational possibilities, and then formulate a plan for all contingencies.

Programmes must be in place beyond simply assuring a safe landing. Obligations to the travelling public dictate that once a safe emergency diversion and landing has occurred, there must be present, at that location, an infrastructure to support the needs of all on board the aircraft until onward travel can be assured and completed.

As such it must be emphasized again that completeness of the Operational Plan for polar areas operations is imperative.

6.4 Content of the Operational Plan

6.4.1 General

The Operational Plan and associated modelling must be predicated on specific strategies that will address the various contingencies to be handled for safe and efficient operations in the harsh polar environment. The plan content must be acceptable to the CAA and shall include, but is not limited to:

(a) The required route and area of operation, defined and thoroughly reviewed, with all hazards, problems and special requirements identified and provided for.

(b) En-route alternate airports selected, identified, and validated for suitability.

(c) Fuel Freeze Monitoring and Management programs put in place, and all necessary air and ground staff trained in their use.

(d) Aircraft Communications and Navigation systems ensured as serviceable and validated for operational use.

(e) MEL considerations reviewed and prepared to meet the requirements.

(f) All relevant personnel fully trained to the requirement of their positions and relationship to the Polar Operation.

(g) Established long range requirements for crewing and rostering in place.

(h) Programmes in place for the gathering, dissemination, and flight following of Space Weather data for each operating flight.

(i) Special equipment obtained and stored as required on each aircraft used for Polar Operations.

(j) Planning made well in advance with the details of the Reaction and Recovery Protocols.

6.4.2 Rostering and Scheduling

Based on the length of the flights to be accomplished, provisions for pre-flight rest, length of layover, post flight pattern recovery times, and additional off times must be considered.

6.4.3 Crew Complement, Qualifications and Training

Flight crew should have adequate operational experience on long flights with augmented crew and familiarity with crew rest patterns en-route.

Cabin crew numbers must meet the minimum required, with sufficient crew carried to ensure adequate rest for the course of the flight.

7. APPLICATION AND CERTIFICATION PROCESS

7.1 Application

In order to conduct flight operations in the polar areas as defined, an operator must satisfy the CAA that the proposed operation can be conducted safely. Form SM 159 (GA) or Form SM 159A (CAT) must be submitted before any proposed polar route operations together with the following supporting documentation.

(a) Aircraft approval (AFM or STC);

(b) Risk assessment through the operator SMS;

(c) The operator's operational plan in accordance with paragraph 6 above;

(d) Proposed commencement of route schedule;

(e) Proposed crew rostering and scheduling procedures (CAT only);

(f) Proposal for operational staff training programme (CAT only);

(g) Sample of the required navigational charts (CAT only); and

(h) Draft Operations Manual amendment (note that the proposed operational plan may be incorporated into the Operations Manual or be a separate controlled document.)

In the application Form SM 159, General Aviation operators must include the required supporting documentation and shall sign the "Declaration of Compliance" indicating all equipment, operational requirements, documentation and training meet the requirements for polar route operations.

7.2 Document Review Phase

The CAA shall review the operator submitted documents, to ensure all requirements of this CAP are considered, and this should be a consultative process involving liaison between the CAA and the operator.

7.3 Demonstration and Validation Phase

7.3.1 Demonstration Phase

The demonstration phase will require assessment in the following areas:

(a) The passenger recovery plan (simulated reaction and recovery to one of the designated en-route alternates);

(b) Flight crew and operational staff training with a sample of actual training sessions; and

(c) Inspection of the required special equipment.

7.3.2 Validation Phase

A validation flight will be required for commercial scheduled operations or operations requiring EDTO approval. A validation flight may be required in other circumstances.

In the event the CAA requires a validation flight to be performed adequate notice must be provided prior to conducting a CAA observed flight. The inspector will witness the effectiveness and adequacy of its reaction and recovery plan in the event of a diversion to one of its designated en-route alternate airports with emphasis on the following areas of the operation:

(a) Communications;

(b) Coordination;

(c) Facilities;

(d) Accuracy of Notices to Airman and weather information; and

(e) Operability of ground equipment during the simulated diversion.

The CAA will consider conducting the evaluation flight on a passenger revenue flight if the operator's passenger recovery plan has been previously and satisfactorily demonstrated to the CAA. If the operator elects to demonstrate its passenger recovery plan as part of and during its validation flight, the flight may not be conducted in a commercial revenue environment. The carriage of commercial cargo is permitted.

7.4 Certification Process

Once all requirements have been satisfactorily completed and validated by the CAA, the approval will be issued on a Specific Approval Certificate for General Aviation operators, and the Operations Specifications of an AOC. A copy of the approval must be carried in the aircraft for all flights.

8. MONITORING AND OVERSIGHT

8.1 Management Responsibility

Should there be any in-flight diversion to en-route alternate airports in the polar areas, the operator must ensure it has an operational plan to ensure safety, cater to physiological needs and expeditious evacuation of passenger and crew. This plan should cover but not limited to the equipment required and the configuration of the airplane.

The operator must conduct an annual audit of his recovery plan for accuracy and completeness. The operator's management remains responsible for the monitoring and oversight of the preparation, development, implementation and operation of all flight operations into the polar areas.

8.2 Flight Operations Responsibility

The operator's flight operations department is responsible for the oversight and monitoring. This will include but is not limited to Space Weather and en-route alternate airports conditions and availability. Any changes affecting the flight will be dispatched to the operating aircraft by the quickest means possible.

8.3 Flight Crew Feedback and Operational Review

Operators operating into the polar areas are requested to obtain feedback from crews flying the routes. This will assist in identifying any further issues that should be addressed.