AUSTRALIA

Refer to Notams, Jeppesen Charts and Pacific Flight Supplement Booklet for information on rules and procedures, frequencies, RVSM and AUSOTS.

- At major Australian airports, the national frequency of 131,0 Mhz is available for direct communications between Fire Commander and Pilots during emergencies.
- In general, the air traffic rules and procedures are conform with ICAO standards, recommended practices and procedures.
- Curfews are effective in some airports (refer to Jeppesen).
- Strategic lateral off-set procedure and Mach number technique implemented in some areas (Oceanic control areas), refer to jeppesen.
- Initial contact with ATC shall use Heavy in front of the call-sign.
- Continue to squawk allocated transponder code or 3000 (if none allocated) until reaching the Australian FIR boundary.
- Melbourne radar has extended coverage, once identified, you can expect track shortening upon request.
- En route weather updates available on VHF Volmet.
- Normally a speed restriction of 250kts applies below FL100.
- Whole Australian Airspace is RVSM.
- R-NAV routes widely used.
- In some areas not covered by radar, mandatory broadcast zones apply.
- CPDLC is widely used.
- Procedures when AIR TRAFFIC SERVICES TEMPORARILY NOT AVAILABLE
- Air Services Australia Safety Bulletin – *ILS Multipath Protection*

Australian ATC Readback Procedures
AirServices Australia requires all crew operating into Australian airfields to a full readback of taxi instructions by ATC.

ICAO Annex 10, Vol 2, Paragraph 5.1.1.1 states 'standardized phraseology shall be used in all situations for which it has been specified. Only when standardized phraseology cannot serve an intended transmission, plain language shall be used.'

Australian AIP GEN 3.4 paragraph 4.4.1c requires 'any route and holding point specified in the taxi clearance to be readback'. It has been noted that crews are regularly omitting a full readback in particular the words 'holding point'.

Example:

ATC : [callsign] taxi to holding point Alpha four runway one eight

PILOT : Taxi to holding point Alpha four runway one eight [callsign]

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CHINA

Refer to Notams, Jeppesen Charts and ASIA Flight Supplement Booklet for information on rules and procedures, frequencies and RVSM.

- In general, the air traffic rules and procedures are in conformity with ICAO standards, recommended practices and procedures.
- Altitude reference system in meter.
- CPDLC available on certain routes.
- A lot of the ATC radio traffic is done in Chinese, leading to some situation awareness problems.
- See Appendix 1 for China AIP information on Altimeter settings.
- See appendix 2 for information on RVSM and strategic lateral offset procedures.
- See Appendix 3 for Airbus FCOM bulletin for altimeter setting in meter.

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APPENDIX 1

ENR 1.7 高度表拨正程序

1. 介绍

中国高度表拨正程序基本与国际民用航空组织 8168 文件第一卷第六部分相一致，详见以下规定。

仪表进近图、仪表进场图和仪表离场图提供过渡高度或过渡高和过渡高度层。

用以确定足够地形超障高度的机场修正海平面气压(QNH)或机场场面气压(QFE)报告和温度通过气象广播提供，并可向空中交通服务单位申请得到。QNH 或 QFE 值的单位为百帕。

2. 高度表拨正值的规定

2.1 航路飞行

航路飞行的高度表拨正值为 1013.2 百帕。

2.2 机场塔台管制区域飞行

2.2.1 在规定过渡高度和过渡高度层的机场：

在机场高度表拨正区域内规定的过渡高度及其以下飞行，高度表拨正值为机场修正海平面气压；在过渡高度层及其以上飞行，为 1013.2 百帕。

2.2.2 在规定过渡高和过渡高度层的机场：

在机场高度表拨正区域内规定的过渡高及其以下飞行，高度表拨正值为机场场面气压；在过渡高度层及其以上飞行，为 1013.2 百帕。

2.2.3 在没有规定过渡高度或过渡高和过渡高度层的机场

详见 ENR 1.7 第 3.1.3 款。

ENR 1.7 ALTIMETER SETTING PROCEDURES

1. Briefing

China's altimeter setting procedures in use basically conform to those contained in ICAO Doc 8168, Vol. I, Part 6, with details as follows:

Transition altitudes or transition heights and transition levels are given on the instrument approach charts and STAR/SID charts. QNH or QFE reports and temperature information for use in determining adequate terrain clearance are provided in MET broadcasts and are available on request from the air traffic services. QNH or QFE values are given in hectopascals.

2. Altimeter settings to be used

2.1 En-route flight

The altimeter setting for en-route flight is 1013.2hPa.

2.2 Flights within aerodrome tower control areas

2.2.1 At aerodromes where transition altitudes and transition levels are established:

QNH shall be used for flights at or below the transition altitude specified in the aerodrome Altimeter Setting Regions; 1013.2hPa shall be used for flights at or above the transition level.

2.2.2 At aerodromes where transition heights and transition levels are established:

QFE shall be used for flights at or below the transition height specified in the Aerodrome Altimeter Setting Regions; 1013.2hPa shall be used for flights at or above the transition level.

2.2.3 At aerodromes where transition altitudes or transition heights and transition levels are not established

Ref. subsection ENR 1.7, item 3.1.3 for details.

2.2.4 高原机场

高原机场的飞行使用 1013.2 百帕。

2.2.4 At aerodromes of high elevation 1013.2hPa shall be used for flight operations.

3. 高度表拨正程序

3. Altimeter setting procedures

3.1 航空器起飞或降落时，高度表拨正程序按照下列规定进行:

3.1 When an aircraft is taking off from or landing at an aerodrome, the following altimeter setting procedures are to be observed:

3.1.1 规定过渡高度和过渡高度层的机场

航空器起飞前，应当将机场修正海平面气压的数值对正航空器上气压高度表的固定指标；航空器起飞后，上升到过渡高度时，应当将航空器上气压高度表的气压刻度 1013.2 百帕对正固定指标；当航空器在下降过程中穿越过渡高度层时，应当将机场修正海平面气压的数值对正航空器上气压高度表的固定指标。

3.1.1 At aerodromes where transition altitudes and transition levels are established

Before take-off, the aircraft altimeter subscale shall be set to QNH of the aerodrome; after take-off, upon reaching the transition altitude the altimeter subscale shall be set to 1013.2hPa; when an aircraft is passing through a transition level during descent, the altimeter subscale shall be set to QNH of the aerodrome.

3.1.2 规定过渡高和过渡高度层的机场

航空器起飞前，应当将机场场面气压的数值对正航空器上气压高度表的固定指标；航空器起飞后，上升到过渡高时，应当将航空器上气压高度表的气压刻度 1013.2 百帕对正固定指标。

当航空器在下降过程中穿越过渡高度层时，应当将机场场面气压的数值对正航空器上气压高度表的固定指标。

3.1.2 At aerodromes where transition heights and transition levels are established

Before take-off, the aircraft altimeter subscale shall be set to the atmospheric pressure at the aerodrome elevation; after take-off, upon reaching the transition height the altimeter subscale shall be set to 1013.2hPa; when an aircraft is passing through a transition level during descent, the altimeter subscale shall be set to the atmospheric pressure at the aerodrome elevation.

3.1.3 没有规定过渡高度或过渡高和过渡高度层的机场

航空器起飞前,应当将机场场面气压的数值对正航空器上气压高度表的固定指标；航空器起飞后，上升到 600 米高时，应当将航空器上气压高度表的气压刻度 1013.2 百帕对正固定指标。在机场塔台管制区域内的下降过程中，航空器应根据空中交通管制员的指令开始调表。

3.1.3 At aerodromes where transition altitudes or transition heights and transition levels are not established

Before take-off, the aircraft altimeter subscale shall be set to the atmospheric pressure at the aerodrome elevation; after take-off when the aircraft has reached a height of 600m, the altimeter subscale shall be set to 1013.2hPa. During the process of descending in the aerodrome tower control area, the aircraft shall start altimeter setting by the instruction of air traffic controller.

3.1.4 高原机场

航空器起飞前，当航空器上气压高度表

3.1.4 At aerodromes of high elevation

When the aircraft altimeter subscale cannot be set to the

的气压刻度不能调整到机场场面气压的数值时，应当将气压高度表的气压刻度 1013.2 百帕对正固定指标（此时所指示的高度为零点高度）。

航空器降落前，如果航空器上气压高度表的气压刻度不能调整到机场场面气压的数值时，应当按照降落机场空中交通管制员通知的假定零点高度（航空器着陆时所指示的高度）进行着陆。

atmospheric pressure at the aerodrome elevation, it will then be set to 1013.2hPa before take-off, with the indicated altitude interpreted as zero altitude.

When the aircraft altimeter subscale cannot be set to the atmospheric pressure at the aerodrome elevation, landing is to be made with the assumed zero altitude notified by the air traffic controller before landing.

3.1.5 为了安全实施高度表拨正，在机场地区划设了高度表拨正区域。要求低于过渡高度飞行的航空器，在进出高度表拨正区域的水平边界时或根据空中交通管制员的指示开始调整高度表，该水平边界详见 ENR 1.7 第 4 款。

3.1.5 For the safe execution of altimeter setting, Aerodrome Altimeter Setting Regions are defined. An aircraft below the transition altitude is required to start its altimeter setting when entering or leaving the lateral boundary of Altimeter Setting Region or by following the instruction of the air traffic controller. For details of lateral boundaries, please refer to subsection ENR 1.7, item 4.

3.2 航路飞行的垂直间隔，按照飞行高度层配备。飞行高度层按照以下标准划分：

a. 真航线角在 0 度至 179 度范围内，高度由 900 米至 8 100 米以及 8 900 米至 12 500 米，每隔 600 米为一个高度层；高度在 12 500 米（不含）以上，每隔 1 200 米为一个高度层。

b. 真航线角在 180 度至 359 度范围内，高度由 600 米至 8 400 米以及 9 200 米至 12 200 米，每隔 600 米为一个高度层；高度在 13 100 米以上，每隔 1 200 米为一个高度层。

c. 飞行高度层根据标准大气压条件下假定海平面计算，真航线角从航线起点和转弯点量取。

飞行高度层的具体配备标准见飞行高度层配备示意图（ENR 1.7-7 页）。

3.2 En-route vertical separations are based on flight level allocation. Flight levels are determined by the following criteria:

a. For a true track between 0° – 179°, a flight level at every 600m from 900m up to 8 100m and 8 900m up to 12 500m; a flight level at every 1 200m above 12 500m.

b. For a true track between 180° – 359°, a flight level at every 600m from 600m up to 8 400m and 9 200m up to 12 200m; a flight level at every 1 200m above 13 100m.

c. The flight level shall be calculated on the basis of presumed sea level under standard atmospheric pressure conditions. True track shall be measured from the starting or turning point of the air route.

For specific flight level allocation criteria, see diagram of flight levels allocation (page ENR1.7-7).

4. 高度表拨正区域 Description of altimeter setting regions

机场的过渡高度（高）和过渡高度层详见第三部分—机场（AD）。
The transition altitudes/heights and transition levels for aerodromes, Ref. Part III—aerodrome (AD) for details.

机场名称 Name of Aerodrome	侧向界限 Lateral Boundaries	备注 Remarks
北京/首都 BEIJING/Capital	Dawangzhuang VOR—Qingbaikou NDB—Huailai NDB—Tanghekou NDB—Gubeikou NDB—Shigezhuang NDB—Dawangzhuang VOR.	
长春/龙嘉 CHANGCHUN/Longjia	N432410 E1251500 — N434341 E1250400 — N441937 E1252030 — N442540 E1255533 — N440110 E1263935 — N434131 E1263716 — N432632 E1254645 — N432410 E1251500	
长沙/黄花 CHANGSHA/Huanghua	N273743 E1133143 — N274400 E1123124 — N280400 E1121234 — N284900 E1130406 — N284300 E1135554 — N273754 E1135054 — N273743 E1133143	
成都/双流 CHENGDU/Shuangliu	N310847 E1042246 — N310412 E1044210 — N304900 E1045548 — N303800 E1045703 — N300701 E1044030 — N295546 E1041814 — N293400 E1034600 — N293600 E1032900 — N295900 E1030000 — N310000 E1033700—N310847 E1042246	
重庆/江北 CHONGQING/Jiangbei	By ATC	
大连/周水子 DALIAN/Zhoushuizi	By ATC	
福州/长乐 FUZHOU/Changle	A circle with a radius of 74km centered on Fuzhou VOR/DME.	
广州/白云 GUANGZHOU/Baiyun	N241229 E1132442 — N233818 E1122554 — N230417 E1122907 — N224800 E1122918 — N222606 E1130000 — N223730 E1131942 — N225254 E1132900 — N225400 E1140342 — N231524 E1141118 — N233855 E1141941—N240706 E1135618—N241229 E1132442	
桂林/两江 GUILIN/Liangjiang	N2552 E11023—ONEMI—N2536 E11048—N2448 E11058—Ertang NDB—N2431 E11036—N2427 E10959—N2440 E10951—N2448 E10934—N2538 E10930—Sanjiang NDB—N2555 E10955—N2552 E11023.	
贵阳/龙洞堡 GUIYANG/Longdongbao	N270236 E1060142 — N262502 E1061530 — N253725 E1063326 — N261356 E1075250 — N264831 E1074121 — N271804 E1071745 — N270236 E1060142	
海口/美兰 HAIKOU/Meilan	N2030.0 E10943.5—N1915.0 E10943.5—N1915.0 E11130.0—N2030.0 E11130.0—N2030.0 E10943.5.	
海拉尔/东山 HAILAR/Dongshan	A circle with a radius of 55km centered on Hailar VOR/DME.	
杭州/萧山 HANGZHOU/Xiaoshan	SUPAR—N3042.0 E12019.0—N3033.0 E11957.5—N3000.0 E12001.0—Arc of a circle with a radius 55km centered on N3014.4 E12027.5—SUPAR.	
哈尔滨/太平 HARBIN/Taiping	N460638 E1262223 — N454751 E1265050 — N453212 E1265748 — N452250 E1263756 — N450936 E1260042 — N451951 E1254042 — N455846 E1254459—N460638 E1262223.	

合肥/骆岗 HEFEI/Luogang	A circle with a radius of 55km centered on Hefei VOR/DME.	
呼和浩特/白塔 HOHHOT/Baita	A circle with a radius of 55km centered on Locator 'KJ'.	
和田/和田 HOTAN/Hotan	By ATC	
佳木斯/佳木斯 JIAMUSI/Jiamusi	By ATC	
济南/遥墙 JINAN/Yaoqiang	A circle with a radius of 55km centered on Jinan VOR/DME.	
喀什/喀什 KASHI/Kashi	A circle with a radius of 55km centered on Kashi VOR/DME.	
昆明/巫家坝 KUNMING/Wujiaba	N261600 E1030542 — N255106 E1033420 — N253636 E1034914 — N243224 E1034430 — N240630 E1024530 — N240354 E1020006 — N242900 E1013237—N250206 E1013224—N261600 E1030542	
兰州/中川 LANZHOU/Zhongchuan	A circle with a radius of 55km centered on Lanzhou VOR/DME.	
牡丹江/海浪 MUDANJIANG/Hailang	By ATC	
南昌/昌北 NANCHANG/Changbei	A circle with a radius of 55km centered on Changbei VOR/DME.	
南京/禄口 NANJING/Lukou	A circle with a radius of 55km centered on Nanjing VOR/DME.	
南宁/吴圩 NANNING/Wuxu	By ATC	
宁波/栎社 NINGBO/Lishe	Andong VOR — SUPAR — N2946 E12051 — N2942 E12100 — N2955 E12200—Arc of DME30 NGB(Ningbo VOR/DME)—Andong VOR.	
青岛/流亭 QINGDAO/Liuting	A circle with a radius of 55km centered on Qingdao VOR/DME.	
三亚/凤凰 SANYA/Phoenix	A circle with a radius of 50km centered on aerodrome DME (IKK).	
上海/虹桥 SHANGHAI/Hongqiao 上海/浦东 SHANGHAI/Pudong	Wuxi VOR—PIKAS—Nantong VOR—BUNVA—UDOXI—IBEGI—N3146.2 E12246.5 — EMSAN — DUMET — N3112.7 E12246.5 — BONGI — PONAB — RUXIL — N3015.0 E12212.0 — BAVIK(N3021.4 E12140.9)—IDNIK—DADAT—Nanxun NDB—Wuxi VOR *Note: 1. Above 900m:use Pudong QNH;* *2. 900m or below: use QNH of departure or landing aerodrome.*	
沈阳/桃仙 SHENYANG/Taoxian	By ATC	
深圳/宝安 SHENZHEN/Baoan	Same as Zhuhai Terminal Control Area	

石家庄/正定 SHIJIAZHUANG/Zhengding	A circle with a radius of 55km centered on Zhengding VOR/DME.	
太原/武宿 TAIYUAN/Wusu	A circle with a radius of 55km centered on Taiyuan VOR/DME.	
天津/滨海 TIANJIN/Binhai	N391224 E1163501 — N392400 E1170500 — N393000 E1175755 — N392615 E1180330 — N385911 E1180909 — N384759 E1180340 — N384400 E1175755 — N384700 E1170330 — N390832 E1163514 — N391224 E1163501	
乌鲁木齐/地窝堡 URUMQI/Diwopu	Fukang VOR—N4332.3 E8756.6—N4338.7 E8654.0—N4411.5 E8653.5 —Fukang VOR	
威海/大水泊 WEIHAI/Dashuipo	By ATC	
武汉/天河 WUHAN/Tianhe	Hekou NDB—N3126 E11457—N3026.2 E11516.1—N2953 E11417—Longkou VOR—N3012 E11313—Tianmen NDB—N3116 E11341—Hekou NDB	
厦门/高崎 XIAMEN/Gaoqi	A circle with a radius of 40NM centered on Xiamen VOR/DME.	
西安/咸阳 XI'AN/Xianyang	Ningshan VOR—Changwu NDB—Yijun VOR—N3352.5 E10956.1—Ningshan VOR	
西昌/青山 XICHANG/Qingshan	A circle with a radius of 55km centered on Xichang VOR/DME.	
西双版纳/嘎洒 XISHUANGBANNA/Gasa	A circle with a radius of 55km centered on Xishuangbanna VOR/DME.	
延吉/延吉 YANJI/Yanji	By ATC	
烟台/莱山 YANTAI/Laishan	By ATC	
郑州/新郑 ZHENGZHOU/Xinzheng	A circle with a radius of 55km centered on Xinzheng VOR/DME.	

5. 适用于经营人的程序

飞行中将要使用的高度层必须在飞行计划中说明：

a. 如果在过渡高度层或者其上飞行，使用飞行高度层.

b. 如果在机场附近或在过渡高度之下飞行，使用高度。

注：有些机场使用高而不使用高度。

5. Procedures applicable to operators (including pilots)

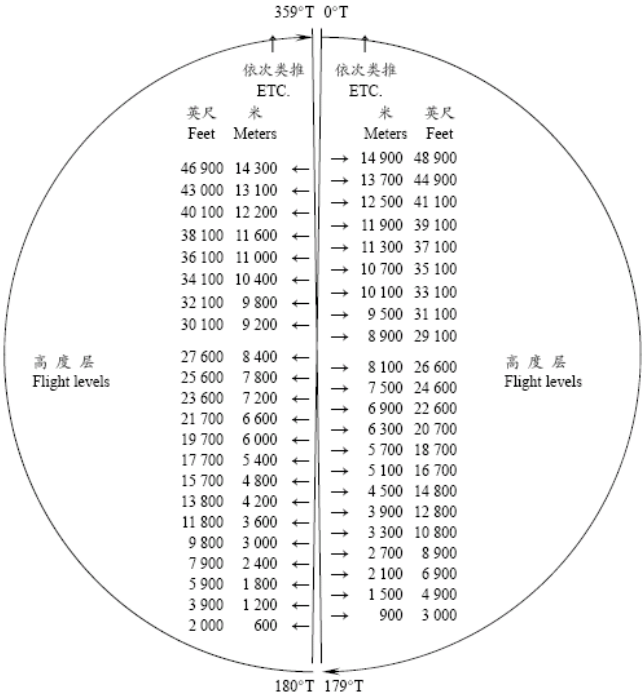
The level at which a flight is to be conducted shall be specified in a flight plan:

a. In term of flight levels, if the flight is to be conducted at or above the transition level, and

b. In terms of altitudes, if the flight is to be conducted in the vicinity of an aerodrome and at or below the transition altitude.

Note: Height is used instead of altitude at some aerodromes.

飞行高度层配备示意图
Diagram of Flight Levels Allocation



注：管制员将发布米制飞行高度层指令。航空器驾驶员应当根据中国民航飞行高度层配备标准示意图（表）来确定对应的英制飞行高度层。航空器应当飞对应的英制飞行高度层。航空器驾驶员应当知晓公英制转换带来的差异，驾驶舱仪表显示的米制高度与管制指令的米制高度不一定完全一致，但存在的差异不会超过 30 米。

Note: ATC will issue the Flight Level clearance in meters. Pilots shall use the China RVSM FLAS Diagram to determine the corresponding flight level in feet. The aircraft shall be flown using the flight level in FEET.

Pilots should be aware that due to the rounding differences, the metric readout of the onboard avionics will not necessarily correspond to the cleared Flight Level in meters however the difference will never be more than 30 meters.

飞行高度层配备标准表

Table of Flight Levels Allocation

180°- 359°T		000°- 179°T	
Flight Levels		Flight Levels	
m	ft	m	ft
ETC.	ETC.	ETC.	ETC.
↑	↑	↑	↑
15500	50900	14900	48900
14300	46900	13700	44900
13100	43000		
		12500	41100
12200	40100	11900	39100
11600	38100	11300	37100
11000	36100	10700	35100
10400	34100	10100	33100
9800	32100	9500	31100
9200	30100	8900	29100
8400	27600	8100	26600
7800	25600	7500	24600
7200	23600	6900	22600
6600	21700	6300	20700
6000	19700	5700	18700
5400	17700	5100	16700
4800	15700	4500	14800
4200	13800	3900	12800
3600	11800	3300	10800
3000	9800	2700	8900
2400	7900	2100	6900
1800	5900	1500	4900
1200	3900	900	3000
600	2000	—	—
m	ft	m	ft

APPENDIX 2

REDUCED VERTICAL SEPARATION MINIMA (RVSM) CHINA AIRSPACE

Effective 21 NOV 07, 1600 UTC:

Metric RVSM will be implemented in the Shenyang, Beijing, Shanghai, Guangzhou, Kunming, Wuhan, Lanzhou, Urumqi FIRs and Sector AR01 (island airspace) of the Sanya CTA between 8900m (FL291) and 12500m (FL411) inclusive. The airspace between 8900m (FL291) and 12500m (FL411) is defined as RVSM airspace. China RVSM airspace is exclusive RVSM airspace, aircraft that are not RVSM compliant may not operate into China RVSM airspace between 8900m (FL291) and 12500m (FL411).

RVSM documentation can be accessed from: http://www.atmb.net.cn/rvsm

FLIGHT LEVEL ALLOCATION SCHEME (FLAS)

China RVSM Flight Level Allocation Scheme (FLAS) is based on Metric Flight Level. ATC will issue the Flight Level clearance in meters, the aircraft shall be flown using the flight level in FEET. There will be no change in flight level allocations and operations at 8400m (FL276) or below in non RVSM airspace.

Pilots should be aware that due to the rounding differences, the metric readout of the onboard avionics will not necessarily correspond to the cleared Flight Level in meters, however the difference will never be more than 30 meters.

Aircraft equipped with metric and feet altimeters shall use the FEET altimeter within RVSM flight level band.

TABLE OF FLIGHT LEVEL ALLOCATION

Aircraft equipped with the altimetry system not capable of flying in FEET shall not flight plan in RVSM airspace.

180° – 359°T			000° – 179°T		
Flight Levels			Flight Levels		
m	ft	FL	m	ft	FL
ETC	ETC	ETC	ETC	ETC	ETC
...	...	...	...	...	...
15500	50900	FL509	14900	48900	FL489
14300	46900	FL469	13700	44900	FL449
13100	43000	FL430	**12500**	**41100**	**FL411**
12200	**40100**	**FL401**	11900	**39100**	**FL391**
11600	**38100**	**FL381**	11300	**37100**	**FL371**
11000	**36100**	**FL361**	10700	**35100**	**FL351**
10400	**34100**	**FL341**	10100	**33100**	**FL331**
9800	**32100**	**FL321**	**9500**	**31100**	**FL311**
9200	**30100**	**FL301**	**8900**	**29100**	**FL291**
8400	27600	FL276	8100	26600	FL266
7800	25600	FL256	7500	24600	FL246
7200	23600	FL236	6900	22600	FL226
6600	21700	FL217	6300	20700	FL207
6000	19700	FL197	5700	18700	FL187
5400	17700	FL177	5100	16700	FL167
4800	15700	FL157	4500	14800	FL148
4200	13800	FL138	3900	12800	FL128
3600	11800	FL118	3300	10800	FL108
3000	9800	FL98	2700	8900	FL89
2400	7900	FL79	2100	6900	FL69
1800	5900	FL59	1500	4900	FL49
1200	3900	FL39	900	3000	FL30
600	2000	FL20			

NOTE: FL291-FL411 RVSM Airspace

AIRCRAFT EQUIPMENT

The Minimum Equipment List (MEL) fulfilling the Minimum Aircraft Systems Performance Specifications (MASPS) consists of: (see FAA Interim Guidance (IG) 91-RVSM/JAA TGL6). Before entering RVSM airspace, the pilot should review the status of required equipment should be operating normally:

a. two primary altimetry systems system should be capable that aircraft can be flown using FL in FEET;
b. one automatic altitude-keeping device; and
c. one altitude-alerting device.

Although ACASII (TCAS Version 7.0) is not specifically required for RVSM it is a requirement in Chinese airspace.

NOTE: The altimetry system requirement shall allow the aircraft to be flown using FEET flight levels.

RVSM COMPLIANCE OPERATIONS:

Qualifications

The operator shall ensure that the pilot has been trained on China RVSM Flight Level Allocation Scheme (FLAS) before the pilot can operate into China airspace.

Means of compliance

Except for State aircraft, operators intending to conduct flights within the volume of airspace where RVSM is applied shall require an RVSM approval either from the State in which the operator is based or from the State in which the aircraft is registered.
To obtain such an RVSM approval, operators shall satisfy the said State that:

a. aircraft for which the RVSM approval is sought have the vertical navigational performance capability required for RVSM operations through compliance with the criteria of the RVSM MASPS;
b. they have instituted procedures in respect of continued airworthiness (maintenance and repair) practices and programs, and
c. they have instituted flight crew procedures for operations in the China RVSM airspace.

NOTE 1: An RVSM approval is not restricted to a specific region. Instead - it is valid globally on the understanding that any operating procedures specific to a given region in this case the ME Region, should be stated in the operations manual or appropriate crew guidance.
NOTE 2: Aircraft that have received State approval for RVSM operations will be referred to as 'RVSM approved aircraft'.
NOTE 3: Aircraft that have not received State approval for RVSM operations will be referred to as 'non-RVSM approved aircraft'.

Guidance material of use to those involved in the initial achievement and continued maintenance of the height-keeping performance capability has been issued by ICAO under the title "Guidance Material on the Implementation of a 300m (1000ft) Vertical Separation Minimum (VSM) in the CH RVSM Airspace".

Detailed technical guidance material on the airworthiness, continued airworthiness, and the operational practices and procedures for the CH RVSM airspace is provided in the Joint Aviation Authorities "Administrative and Guidance Material, Section One: General, Part 3: Temporary Guidance Leaflet No. 6".

Monitoring of flight operations in the CH RVSM airspace shall be conducted to assess the continuing compliance of aircraft with the height-keeping performance requirements.

NOTE: Monitoring will be conducted in accordance with the appropriate material issued by ICAO. When notified, operators will be required to cooperate in the monitoring program.

For additional information refer to CAAC web page:
http://www.castc.org.cn/ccar129
Aircraft altitude—keeping performance monitoring Operators are required to participate in the RVSM aircraft monitoring program. Accessing the Monitoring Agency for Asia Region (MAAR):
http://www.aerothai.co.th/maar

For monitoring services in the China airspace operators should contact the MAAR monitoring contractor as follows:
Monitoring Agency for Asia region (MAAR) AEROTHAI
Address: 102 Ngamduplee Rd. Tungmahamek, Sathorn
Bangkok 10120, THAILAND
Tel: +66–2–287–8154 '
Fax: +66–2–287–8155
Email: maar@aerothai.co.th

COMMUNICATIONS
"Pilot level call"- Except in an ADS or radar environment, pilots shall report reaching any altitude assigned within RVSM airspace.

CONTROLLER / PILOT PHRASEOLOGY

Phrase	Purpose
(call sign) **CONFIRM RVSM APPROVED**	Used by the controller to ascertain the RVSM approval status of the acft.
NEGATIVE RVSM[1]	Used by the pilot to report non-RVSM approval status. a. on the initial call on any frequency within the CH RVSM airspace (controllers shall provide a read back with this same phrase), and b. in all requests for flight level changes c. in all read backs of flight level clearances pertaining to flight levels.
AFFIRM RVSM[1]	Used by the pilot to report RVSM approval status.
CONFIRM WHEN ABLE TO RESUME RVSM[1]	Used by the controller to request confirmation that an aircraft has regained RVSM approved status or a pilot is ready to resume RVSM operations.
(call sign) **UNABLE ISSUE CLEARANCE INTO RVSM AIRSPACE, MAINTAIN** [*or* **DESCEND TO,** *or* **CLIMB TO] FLIGHT LEVEL** *(number)*	Used to deny ATC clearance into CH RVSM airspace.
UNABLE RVSM DUE TURBULENCE[1]	Used by the pilot to report when severe turbulence affects the aircraft's capability to maintain the height-keeping requirements for RVSM.
UNABLE RVSM DUE EQUIPMENT[1]	Used by the pilot to report that the aircraft's equipment has degraded below the minimum aircraft system performance specifications (MASPS).
READY TO RESUME RVSM[1]	Used by the pilot to report the ability to resume operations within the CH RVSM airspace after an equipment or weather-related contingency.
REPORT WHEN ABLE TO RESUME RVSM	Used by the controller to confirm that an aircraft has regained its RVSM approval status or to confirm that the pilot is ready to resume RVSM operations.
[1] indicates a pilot transmission	

WAKE TURBULENCE PROCEDURES
Pilots encountering or anticipating wake turbulence in Chinese RVSM airspace have the option of requesting;
a. FL change, or
b. a vector (if possible) or
c. a lateral offset (no clearance required in remote continental airspace).

STRATEGIC LATERAL OFFSET PROCEDURE (SLOP)

The flight crew may apply strategic lateral offsets on remote continental airspace (Non-radar airspace) when the aircraft is equipped with automatic offset tracking capability. The decision to apply a strategic lateral offset shall be the responsibility of the flight crew.

The strategic lateral offset shall be established at a distance of 1NM or 2NM to the right of the centre line of the en-route relative to the direction of flight. Pilots are not required to inform ATC that a strategic lateral offset is being applied.

Within radar airspace, the strategic lateral offset procedure requires approval by ATC. 1NM offsets are preferred within radar airspace. Pilots applying SLOP in non-radar airspace, may request approval from ATC to continue with the offset upon entering radar airspace.

AIRSPACE SAFETY ASSESSMENT AND MONITORING

Pilot of aircraft operating in accordance with IFR, when deviating for any reason by 90m (300ft) or more from cleared flight level by ATC in RVSM airspace, shall report to the relevant ATS unit concerned via radio or data link, as soon as practicable on the level deviation.

After completion of the flight, the pilot shall also report to the operator the details of deviation.

TRANSITION BETWEEN FL's

During cleared transition between levels, the aircraft should not overshoot or undershoot the assigned FL by more than 45m (150ft).

TRANSITION AREAS

Transition areas and procedures for transition between China RVSM and adjacent FIRs in neighboring countries are indicated on Jeppesen CH(H/L) enroute charts.

Special attention shall be given to the moment when the China meter to feet converse table shall be used for aircraft entering Chinese RVSM airspace;

a. Aircraft with primary FEET altimeters shall fly using the feet altimeter and use the China RVSM conversion table from the initial clearance to a FL in the China FLAS;
b. Aircraft with primary METER altimeters shall switch and fly using the FEET altimeter and use the China RVSM conversion table from the initial clearance to a FL in the China FLAS;
c. Aircraft equipped with the altimetry system not capable of flying in FEET shall not flight plan in RVSM airspace.

NOTE: It is highly recommended that the CAAC China RVSM Conversion Table be used; substantial human factor considerations were accounted for during its development.

Rule of thumb for transitions from ICAO Feet RVSM airspace to Chinese RVSM airspace: Flights entering China climb 100ft, flights leaving China RVSM descend 100ft.

FLIGHT PLANNING REQUIREMENTS

The letter "W" shall be inserted in item 10 (Equipment) of the ICAO standard flight plan to indicate that both the aircraft and operator are RVSM approved. The request metric flight level within China RVSM in Flight Plan shall be expressed as S followed by 4 figures (such as S1250, S1220 and S1190 represent 12500m, 12200m and 11900m respectively).

SPECIAL COORDINATION PROCEDURES FOR CRUISE OPERATION OF NON-RVSM APPROVED AIRCRAFT IN RVSM AIRSPACE

Aircraft that are not RVSM compliant may not flight plan between 8900m (FL291) and 12500m (FL411), except for the following situations:

a. The aircraft is being initially delivered to the State of Registry or Operator;
b. The aircraft was RVSM approved but has experienced an equipment failure and is being flown to a maintenance facility for repairing in order to meet RVSM requirements and/or obtain approval;
c. The aircraft is being utilized for mercy or humanitarian purposes;
d. State aircraft (those aircraft used in military, customs and police services shall be deemed state aircraft)

Aircraft operators requesting that approval shall, if departing from an airport within China FIR's, obtain approval from the Operational Management Center of ATMB of CAAC normally between 4 – 72 hours prior to the expected departure time. The assignment of cruising levels to non-RVSM approved aircraft as listed above shall be subject to an ATC clearance. Aircraft operators shall include the 'STS/Category of operations (i.e FERRY/HUMANITARIAN/MILITARY/ CUSTOMS/POLICE)/NON-RVSM COMPLIANT' in field 18 of the ICAO Flight Plan.

SUSPENSION OF RVSM

Air traffic services will consider suspending RVSM procedures within affected areas of Chinese FIRs when there are pilot reports of greater than moderate turbulence. Within areas where RVSM procedures are suspended, the vertical separation minimum between all aircraft will be 600m (2000ft).

The same RVSM FLAS will be used.

PROCEDURES FOR IMPLEMENTATION DAY

All aircraft that operate or are planning to operate in the RVSM Flight Levels within the China Sovereign Airspace at and beyond **21 NOV 07 1600 UTC** shall comply with the RVSM requirements described above.

All aircraft entering China Sovereign Airspace between 8900m (FL291) and 12500m (FL411) inclusive at and beyond **21 NOV 07 1600 UTC** will be assigned a Flight Level in accordance with the China RVSM FLAS.

All aircraft departing from China Sovereign Airspace airports that need to file a FL between 8900m (FL291) and 12500m (FL411) inclusive at and beyond 21 NOV 07 1600 UTC will be assigned a Flight Level in accordance with the China RVSM FLAS.

Aircraft operating within China Sovereign Airspace at **21 NOV 07 1600 UTC** can expect; **Implementation Phase 21 NOV 07 1530-1630 UTC**

15:30 UTC

ATC will broadcast: "Attention all aircraft, RVSM operations will begin in 30 minutes."

15:30 – 15:45 UTC

ATC will accommodate RVSM noncompliant aircraft at and below FL 8400m.

15:50 UTC

ATC will broadcast: "Attention all aircraft, RVSM operations will begin at 16:00 UTC."

16:00 – 16:30 UTC and onward

ATC will clear RVSM compliant aircraft to climb or descend to the nearest appropriate RVSM FL in accordance with the China RVSM FLAS.

All aircraft operating in RVSM airspace will be cleared in accordance with the China RVSM FLAS.

WEATHER ENCOUNTERS AND AIRCRAFT SYSTEM FAILURES

Initial Pilot Actions in Contingency Situations

Initial Pilot Actions when unable to maintain flight level (FL) or unsure of aircraft altitude-keeping capability:
Notify ATC and request assistance as detailed below:

– Maintain cleared flight level, to the extent possible, while evaluating the situation;
– Watch for conflicting traffic using all available means;
– Alert nearby aircraft by illuminating exterior lights (commensurate with aircraft limitations);
– If unable to contact ATC, broadcast position, flight level and intention on 121.5 MHz.

CONTIGENCY SCENARIOS

PILOT ACTION	CONTROLLER ACTION
Severe Turbulence and / or Mountain Wave Activity (MWA) Induced Altitude Deviation of Approximately 200 feet	
When experiencing severe turbulence and/or MWA induced altitude deviations of approximately 200 feet or greater, pilot will contact ATC and state: "Unable RVSM Due (state reason)"	Assess the traffic situation to determine if the aircraft can be accommodated through the provision of lateral, longitudinal or increased vertical separation and, if so, apply the appropriate minimum.
– If not issued by the controller, request vector clear of traffic at adjacent FL's;	– Advise pilot of conflicting traffic;
– If desired, request FL change;	– Issue FL change, traffic permitting
– Report location and magnitude or turbulence or MWA to ATC.	– Issue PIREP to other aircraft.
Mountain Wave Activity (MWA) Encounters-General	
– Contact ATC and report experiencing MWA; – If so desired, pilot may request a FL change. – Report location and magnitude of MWA to ATC	– Advise pilot of conflicting traffic at adjacent FL. If pilot requests, vector aircraft to avoid merging target with traffic at adjacent RVSM flight levels, traffic permitting; – Issue FL change or re-route, traffic permitting; – Issue PIREP to other aircraft.
Wake Turbulence Encounters	
– Contact ATC and request vector, FL change or if capable, a lateral offset.	– Issue vector, FL change or lateral offset clearance, traffic permitting
Unable RVSM Due to Equipment Failure of Automatic Altitude Control System, Altitude Alerter or All Primary Altimeters	
– Contact ATC and state "Unable RVSM Due Equipment" – Request clearance out of RVSM airspace unless operational situation dictates otherwise.	– Provide 600m (2,000ft) vertical separation or appropriate horizontal separation, – Clear aircraft out of RVSM airspace unless operational situation dictates otherwise.

One Primary Altimeter Remains Operational	
– Cross check stand-by altimeter; – Notify ATC of operation with single primary altimeter – If unable to confirm primary altimeter accuracy, follow actions for failure of all primary altimeters	– Acknowledge operation with single altimeter; – Relay to other controllers or facilities who will subsequently handle the aircraft and any special handling requirement or being provided.
Transponder Failure	
– Contact ATC and request authority to continue to operate at cleared flight level; – Comply with revised ATC clearance, if issued	– Consider request to continue to operate at cleared flight level; – Issue revised clearance, if necessary
Aircraft Requiring Rapid Descent	
– Notify ATC of aircraft location and request FL change as required; – Upon declaring an emergency a pilot may exercise his right and change his assigned flight level. He shall notify ATC immediately and submit a report upon arrival at the destination; – If unable to contact ATC and rapid descent required: – Deviation procedure for level change: turn 30° right and track out 20 kilometers (i.e. deviate right of airway centerline by 10 km or 5 nm), then, turn left to track parallel the original route, then climb or descend to the new level, and then return to the original one (when appropriate) **NOTE: when returning to the original route, be aware that there may be conflicting traffic on that route.** – Establish communications with and alert nearby aircraft by broadcasting, at suitable intervals: flight identification, flight	– Issue ATC clearance to change flight level

level, aircraft position and intention on the frequency in use, as well as on frequency 121.5 MHz (or, as a backup, the VHF inter-pilot air-to-air frequency 123.45 MHz) – Establish visual contact with conflicting traffic; – Turn on all aircraft exterior lights.	

FAR EAST

RULES AND PROCEDURES

In general, the air traffic rules and procedures in force and the organization of air traffic services are in conformity with ICAO Standards, Recommended Practices and Procedures. Check Jeppesen flight supplement booklet for specific States differences.

REDUCED VERTICAL SEPARATION MINIMUM (RVSM)

RVSM airspace has been implemented throughout the region between FL290 and FL410 inclusive. Check Jeppesen charts for specific States RVSM airspace and Transition areas.
Refer to China Briefing for information about China's metric RVSM.

In-flight contingencies procedures for Kuala Lumpur/ Kota Kinabalu and Singapore FIR are extracted from ICAO DOC 4444.
Bangkok, Ho Chi Min / Hanoi, Hong Kong, Manila, Pnomh Penh and Taipei FIRS have adopted similar procedures, except that lateral track separation for in-flight contingencies in Oceanic airspace is 25 NM.

STRATEGIC LATERAL OFFSET PROCEDURE (SLOP)

SLOP is applied only in Oceanic or Remote continental airspace in China, Malaysia, Myanmar, Philippines, Singapore, Vietnam and Japan.

IATA IN-FLIGHT BROADCAST PROCEDURE (IFBP)

Flight crews should maintain a listening watch on frequency 128.95 from 20 minutes before entering YANGON FIR until leaving it.
Check Jeppesen en-route charts for broadcast format.

ATC

In general the standard of ATC is good; however you may experience some difficulties in Thailand and Indonesian airspaces due to pronunciation. Sometimes establishing and maintaining contact within Yangon airspace may be difficult due to coverage and noise.

WEATHER

- **Indonesia:**

Indonesia's climate is controlled by the Asian Monsoon. The northeast monsoon blows from November to March, while the southwest monsoon prevails from May to September. During the transition between the monsoons, winds are usually light and variable. This transition zone is known as the Intertropical Convergence Zone and is often accompanied by more concentrated cloudiness and precipitation.
Rainfall tends to be heavy and usually comes in quick hitting thunderstorms, which tend to occur with greater frequency than anywhere else in the world. Rainfall is greater on the south facing coasts and mountain slopes during the southwest monsoon. On the north-facing coasts and slopes, the northeast monsoon is wetter. Jakarta, lying 6 degrees south of the equator on a north-facing coast, shows this single precipitation peak during the northeast monsoon.

- **Malaysia:**

Malaysia is situated just north of the equator and has an equatorial climate with high temperatures and an abundance of rainfall all year round. Like most of the region, it is influenced by the great Asian monsoon, with northeast winds from November to February and southwest winds from April to September.
During the transition periods between the two monsoons (usually March and September or October), winds are light and variable. This transition is associated with the movement of the Intertropical Convergence Zone. This zone of more concentrated cloudiness and precipitation travels north in March and south in October. Rainfall is enhanced during these transitions.
At Kuala Lumpur, a dual maxima is more clearly seen, tied to the transition between the two monsoons.

- **Thailand:**

Thailand is a tropical climate with a distinct wet season (summer) and an equally distinct dry season (winter). This is because Thailand, like most of Asia, is influenced by the Asian monsoon winds.
The wet season runs from May to October when the southwest monsoon is carrying moisture from the Indian Ocean. This period is generally cloudy, very warm and humid with frequent showers. There are two precipitation maxima in Bangkok. The first is in May at the onset of the wet monsoon. The second, even greater rainfall peak, is in September to early October when tropical disturbances are most prevalent.
The months from November to April are much drier as this is when the drier northeast monsoon winds blow. Rain is usually confined to a few days per month and falls mainly in the south, where the northeast winds can pick up moisture from the Gulf of Siam.

- **Philippines:**

The Philippines is an archipelago of 7,000 islands in the western Pacific just north of the equator. The larger islands are very mountainous. The southernmost islands have an equatorial climate with rather uniform precipitation throughout the year. The rest of the island chain has a tropical monsoon climate much like Indochina with a single period of heavy rainfall. The peak rainfall for most areas occurs from July to October when the southwesterly monsoon blows.

For these islands, the rainfall is enhanced further during the period of August to October, when Pacific typhoons threaten. Most of these typhoons first develop east of the Philippines and then intensify as they move to the South China Sea.

- **Indochina:**

Indochina, which includes Vietnam, Laos and Kampuchea (formerly Cambodia), is a varied land with highlands and populous lowlands. Indochina has a tropical monsoon climate with a dry season during the northeast monsoon (October to April) and a wet season during the summer southwest monsoon season (May to September).
In the north, from Laos across the northern and central parts of Vietnam, cooler temperatures come with the northeast monsoon. Snow may even fall in the highest elevations in northern Vietnam in winter. The lowlands (including the Red River and Mekong River delta regions) of the south (Kampuchea and Vietnam) are sheltered from the cold and tend to remain warm or even hot in the dry season.
Precipitation tends to occur during the southwest monsoon. It is enhanced in the fall by heavy rain from typhoons from the western Pacific. The northeast coast of Vietnam may also see clouds, occasional rain and drizzle with the northeast monsoon, but precipitation amounts tend to be much lower than those in the summer and fall.

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INDIA

Refer to Notams, Jeppesen Charts and Middle East Flight Supplement Booklet for information on rules and procedures, frequencies and RVSM.

- Normally, you should call ATC 10 minutes before entering FIR boundary.
- In general, the air traffic rules and procedures are conform with ICAO standards, recommended practices and procedures.
- **Speed control under non-radar environment:**
  Speed restriction of 250Kts applies below 10.000'. Within 15NM of the VOR/DME serving the aerodrome, speed cannot be greater than 220Kts.
- **Speed control under radar environment for arriving aircraft:**
  Click here for table of speed control under radar environment
- CPDLC available in selected areas, confirm with ATC.
- A lot of problems are reported concerning the communications on Mumbai HF, make extensive use of relays or CPDLC where available.
- There are some provisions for the use of the Strategic Lateral Offset Procedure, refer to Jeppesen Flight Supplement Booklet.
- Upon request you will get some direct routing.

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IRAQ

FOR INFORMATION ONLY. FOR LATEST REGULATIONS REFER TO JEPPESEN, AIP AND NOTAMS.

Local ATC regulations can be found onboard in the Jeppesen supplement booklets or online in jeppesen.com website, chart viewer manuals section.

GENERAL INFORMATION

- ✈ Baghdad FIR.
- ✈ RVSM.
- ✈ Usually under radar coverage on EY routes.
- ✈ VHF on EY routes with good quality.
- ✈ Good ATC phraseology.
- ✈ English accent occasionally difficult to understand.
- ✈ Very busy airspace with usually 20Nm radar separation required.
- ✈ When requested,directs routings are usually approved.
- ✈ Occasionally radio contact with Baghdad Control cannot be established until crossing the FIR boundary
- ✈ Review international interception procedures.
- ✈ Weather radar must be kept ON at all times.
- ✈ Continous monitoring of 121.5 Mhz is mandatory.
- ✈ Transponder must be ON at all times.
- ✈ ATS routes are RNAV 5.
- ✈ Flight are normally required to cross the Baghdad FIR boundary in levelled flight.

OMAA-EUROPE ROUTE.

- Usual entry point from Kuwait FIR is TASMI.
- Northbound flight entering Baghdad FIR from Kuwait FIR will normally be handed over to Baghdad South sector 20 nm before TASMI waypoint (normally 123.0 MhZ).
- Direct routing from TASMI to LONOR waypoints is usually approved.
- Approaching waypoint LONOR the flight will be handed over to Baghdad North (normally 129.1 MhZ). Provide KABAN waypoint estimate on first contact.
- Usual exit point from Baghdad to Ankara FIR (normally 132.9 MhZ) is EMIDO.

EUROPE-OMAA ROUTE.

- ATC frequency normally used by Baghdad in this area is 129.1MhZ
- Approaching waypoint VAXEN the flight will be handed over to Baghdad South (normally 123.0 MhZ).
- Usual exit point to Kuwait FIR is SIDAD.

KENYA

GENERAL INFORMATION.

Nairobi FIR, Nairobi and Mombasa radio.
No need to call 10 min prior FIR crossing.
If no contact with Nairobi radio try Mombasa approach.
Usually under radar coverage on EY routes.
VHF on EY routes with good quality.
Good English.
No 126.9 IATA in-flight broadcasts required.
Position report required at entry and exit of FIR.

OMAA-FAJS-OMAA ROUTE.

Usual entry / exit point to or from Addis Abeba FIR is MA (normally contact with Nairobi on 121.3 or 118.5 about 90 nm before WAV).
When requested, about 50 nm before WAV going south, usually you will get direct to UVUKO.
Exit point to Dar Es Salaam FIR is UVUKO.
Exit point to Mogadishu FIR is ITMAR.

FTTJ-HKJK-OMAA ROUTE.

- Usual entry point from Khartoum FIR is EPLAS.
- Expect to be VHF with Nairobi at EPLAS.
- Usual exit point to Addis FIR is MA.
- Contact Addis 10 minutes before MA

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UNITED KINGDOM

NATS safety notice

EXT 02/2008 Minimum and maximum rates of climb or descent in the UK

There have been a number of losses of separation in the UK since 2007 in which a significant contributory factor was the rate of descent of one of the aircraft involved which was not in compliance with the published minimum rate of descent for flights within controlled airspace. There have also been events in which the rate of climb or descent has impacted on the effectiveness of the Airborne Collision Avoidance Systems (ACAS) and ground based safety nets. This notice is to inform operators, pilots and controllers of the minimum rates of climb or descent in the UK.

The following summary of information is reproduced from the UK AIP ENR 1-1-3-1

NATS external safety notice

Maximum rate of climb or descent

In order to ensure the credible interaction of Airborne Collision Avoidance Systems and ground based safety nets, other than aircraft in emergency and certain specific conditions for military aircraft (as detailed in Military AIP and JSP552), all aircraft when operating under normal circumstances, when inside Controlled Airspace within the London and Scottish FIRs/UIRs **should not operate with a climb or descent rate exceeding 8000 ft per minute.**

Division of Safety note: When 'expedited climb or descent' is required, the AIP does not provide dispensation for controllers to instruct aircraft to exceed 8000ft/ min, other than as specified above.

Aircraft when first approaching a cleared flight level and/or when changing flight level in Controlled Airspace **should ensure that the vertical closure speed is not excessive.** It is considered that, with about 1500 ft to go to a cleared level, vertical speed should be reduced to a maximum of 1500 ft per minute and ideally to between 1000 ft per minute and 500 ft per minute. Pilots should ensure that the aeroplane neither undershoots nor overshoots the cleared level by more than 150 ft, manually overriding if necessary.

Minimum rate of climb or descent

In order to ensure that controllers can accurately predict flight profiles to maintain standard vertical separation between aircraft, pilots of aircraft commencing a climb or descent in accordance with an ATC Clearance should **inform the controller if they anticipate that their rate of climb or descent during the level change will be less than 500 ft per minute, or if at any time during such a climb or descent their vertical speed is, in fact, less than 500 ft per minute.**

This requirement applies to both the en-route phase of flight and to terminal holding above Transition Altitude.

Note: This is not a prohibition on the use of rates of climb or descent of less than 500 ft per minute where necessary to comply with other operating requirements.

NATS external safety notice

Produced by: Division of Safety
Contact: Jez Pigden
Tel: 01489 616500

Effective Date: 03/07/08

SAFETY REGULATION GROUP

FLIGHT OPERATIONS COMMUNICATION

Civil Aviation Authority

09/2010

Applicability: All AOC Holders and General Aviation Pilots who Follow Instrument Flight Rules

STANDARD INSTRUMENT DEPARTURE (SID) AND STANDARD ARRIVAL (STAR) CLIMB AND DESCENT PROCEDURES AND PHRASEOLOGY

1 Introduction

1.1 Edition 15 (November 2007) of International Civil Aviation Organization (ICAO) Doc 4444 (PANS-ATM) introduced revised procedures and phraseology associated with climb and descent instructions issued to aircraft following a SID or a STAR. FODCOM 16/2009 informed operators of this change, explained that UK procedures and radiotelephony (RTF) phraseology were different, and provided advice on how UK operators should comply with the ICAO procedures when operating outside of UK airspace.

1.2 The purpose of this FODCOM is to re-emphasise UK procedures and guidance, and also to update operators on recent ICAO developments.

1.3 Detailed information on the origin of the ICAO procedure change, CAA actions undertaken, and ICAO activity can be found at: www.caa.co.uk/atsdocuments.

1.4 This FODCOM replaces FODCOM 16/2009.

2 Procedures and Phraseology within UK Airspace

2.1 In the UK, for all stages of flight, instructions to climb or descend cancel any previous restrictions, unless they are reiterated as part of that instruction. Additionally, to emphasise the UK differences from ICAO, when an aircraft is on a SID and is required to climb directly to the cleared level, ignoring the vertical profile of the SID, controllers will include the word **'now'.**

e.g. "Jet 123 climb now FL 120" means that the aircraft should climb directly to FL 120, ignoring the vertical profile of SID.

2.2 When an instruction is issued that amends a SID route, the level restrictions associated with that SID are no longer applicable. Therefore, in such circumstances, controllers will reiterate the level profile to be followed as part of such an instruction

e.g. "fly heading 095, climb now FL 80" or "route direct EFG, climb now altitude 5,000 feet".

2.3 In the UK, levels to be flown on STARs are as directed by Air Traffic Control (ATC), although the relevant charts contain level information for planning purposes.

3 Procedures and Phraseology Outside UK Airspace

3.1 Under the revised ICAO procedures, when receiving subsequent climb/descent instructions, aircraft following a SID/STAR shall continue to follow the published vertical profile of the SID/STAR, unless the procedure is explicitly cancelled by ATC. However, the ICAO changes do not affect level clearances provided to aircraft in other phases of flight where, unless reiterated, any new clearance cancels a previously issued level restriction. The ICAO procedures and RTF phraseology are fully detailed in paragraph 4.

3.2 A number of States have implemented the revised ICAO procedures, whilst others have not. Outside UK airspace, crews should assume that ICAO-compliant procedures and phraseology are in use unless a notification of a difference is filed in an individual State's Aeronautical Information Publication (AIP). Crews should follow the ICAO procedures unless operating in a State that has notified a difference or

FLIGHT OPERATIONS COMMUNICATION - 09/2010

where the operator has determined that the revised PANS-ATM procedure has not been adopted. (The revised ICAO procedures and RTF phraseology are given below in paragraph 4.)

3.3 Guidance to crews should recommend that, in the case of any doubt about the intention of a clearance, they should request clarification from ATC. If doubt arises when airborne, the safest course of action will always be to follow the SID/STAR profile while seeking clarification.

4 Revised ICAO Procedures and RTF Phraseology.

The revised procedures introduced in ICAO Doc 4444 in November 2007 are as follows.

4.1 Aircraft on a SID

4.1.1 For a SID ICAO Doc 4444 states (paragraph 6.3.2.4):

'When a departing aircraft on a SID is cleared to climb to a level higher than the initially cleared level or the level(s) specified in a SID, the aircraft shall follow the published vertical profile of a SID, unless such restrictions are explicitly cancelled by ATC.'

4.1.2 When the level restrictions are explicitly cancelled, the ICAO phraseology for a SID (paragraph 12.3.1.2(z) of ICAO Doc 4444) is:

"CLIMB TO (level) LEVEL RESTRICTION(S) (SID designator) CANCELLED"

or

"CLIMB TO (level) LEVEL RESTRICTION(S) (SID designator) AT (point) CANCELLED".

e.g. "Jet 123 Climb to FL 100 level restrictions DEVAL 1G cancelled" means that the aircraft should climb directly to FL 100, ignoring the vertical profile of SID DEVAL 1G.

NOTE: In the UK 'to' is not used in connection with flight levels in order to reduce the possibility of misunderstanding in circumstances where the flight level includes the figure two, e.g. flight level 220. (CAP 413 Appendix 1 refers.)

4.1.3 When the level restrictions are not explicitly cancelled, the ICAO phraseology for a SID (paragraph 12.3.1.2(a) of ICAO Doc 4444) is:

"CLIMB TO (level)".

e.g. "Jet 123 Climb to FL 100" means that the aircraft should follow the vertical profile of SID DEVAL 1G to its completion and then climb to FL 100.

4.2 Aircraft on a STAR

4.2.1 For a STAR ICAO Doc 4444 (paragraph 6.5.2.4) states:

'When an arriving aircraft on a STAR is cleared to descend to a level lower than the level or the level(s) specified in a STAR, the aircraft shall follow the published vertical profile of a STAR, unless such restrictions are explicitly cancelled by ATC. Published minimum levels based on terrain clearance shall always be applied.'

4.2.2 When the level restrictions are explicitly cancelled, the ICAO phraseology for a STAR (paragraph 12.3.1.2(aa) of ICAO Doc 4444) is:

"DESCEND TO (level) LEVEL RESTRICTION(S) (STAR designator) CANCELLED"

or

"DESCEND TO (level) LEVEL RESTRICTION(S) (STAR designator) AT (point) CANCELLED".

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e.g. "Jet 123 Descend to 3000 feet level restrictions GOKUL 2J cancelled" means that the aircraft should descend directly to 3000 feet, ignoring the vertical profile of STAR GOKUL 2J.

4.2.3 When the level restrictions are not explicitly cancelled, the ICAO phraseology for a STAR (paragraph 12.3.1.2(a) of ICAO Doc 4444) is:

"DESCEND TO (level)".

e.g. "Jet 123 Descend to 3000 feet" means that the aircraft should follow the vertical profile of STAR GOKUL 2J to its completion and then descend to 3000 feet.

4.3 Aircraft in Other Phases of Flight

4.3.1 In all other phases of flight a climb or descent instruction from ATC automatically cancels any previous ATC instruction.

5 ICAO Safety Review

5.1 As a result of safety concerns regarding the revised Doc 4444 procedures, ICAO initiated a review to determine the extent and severity of difficulties being encountered. From the State responses, ICAO has identified that their current provisions have not provided the intended simplicity, efficiency, and global standardisation to ensure flight safety. Consequently ICAO has reported that they will be working expeditiously to determine the optimum solution and will coordinate with States, Air Navigation Service Providers and international organisations. Certain parties may be requested to conduct simulations in support of this effort. Additionally, ICAO has recommended that States promulgate, with urgency, any difference from the PANS-ATM SID/STAR provisions in the national AIP. The UK has published an ICAO difference in the UK AIP Gen 1.7, Doc 4444, Chapter 6/paragraph 6.3.2.4.

5.2 The CAA continues to work with the UK aviation industry, with ICAO, and in Europe towards a satisfactory solution. When the proposed ICAO solution is promulgated, a UK review will be undertaken to establish if the current ICAO difference can be removed.

6 Operators' Responsibilities

6.1 The revised ICAO procedures represent a significant change to the way crews are expected to respond to climb/descend instructions whilst following a SID or a STAR. There is a potential for confusion, which will have flight safety implications if these new procedures are not followed correctly in each individual State. Operators should ensure that company Standard Operating Procedures are updated, and crews are adequately briefed and appropriately trained. Training personnel should be given guidance on how these changes are to be incorporated into training programmes with particular reference to the correct simulation of ATC phraseology.

6.2 Operators flying to destinations outside the UK should ensure that crews are aware of those States whose SID/STAR ATC phraseology does not conform to ICAO Doc 4444. Crews should be required to report any instances of the use of phraseology or procedures that do not correspond to those notified for the State concerned.

7 Recommendation

7.1 Operators should ensure that their crews are reminded that the current UK procedures remain in force (SI 2010/04 refers); that crews are appropriately briefed about, and trained in, the changes to SID/STAR procedures and phraseology that they may encounter outside UK airspace; and that their guidance is amended accordingly.

8 Queries

8.1 Any queries as a result of this Flight Operations Communication should be addressed to the operator's Flight Operations Inspector (FOI), or for those who do not have an assigned FOI to the Head of Flight Operations Policy at the following e-mail address: FOP.Admin@caa.co.uk.

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Recipients of new Flight Operations Communications are asked to ensure that these are copied to their 'in house' or contracted maintenance organisation, to relevant outside contractors, and to all members of their staff who could have an interest in the information or who need to take appropriate action in response to this Communication. Flight Operations Communications can be accessed directly via the website www.caa.co.uk/fodcoms.

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POLAR OPERATIONS

BACKGROUND

The weather and wind patterns over the Polar Region, during certain periods of the year, makes the use of great circle routes over the North Pole the most efficient routes for flights between North America and the Middle East.

A flight is considered to be operating in the North Pole Region when flying north of Latitude 78^0 North.

GENERAL

While the Polar Region provides the most efficient routes, they traverse some of the harshest landscapes and atmospheric environments. These present different challenges and require added considerations.
The areas of particular concern when operating in the Polar Region are:

- Effects of radiation from solar activity
- Polar navigation and communications
- Fuel freeze point and cold fuel management
- Inflight diversion and enroute alternates

Detailed procedures and operating techniques may be found in the relevant sections of the Operation Manuals (OM-A, OM-B, OM-C). Route and communication information can be found in the Jeppesen reference Manual and relevant Jeppesen charts.

FLIGHT PLANNING

A “Polar Plotting Chart” is provided with the briefing documents for the flights operating through the Polar Region. The chart must be returned with the flight envelope. A spare Polar Orientation Chart shall be collected at the Briefing Center and left in the envelope if not used.

Affected FIRs in the Polar Region

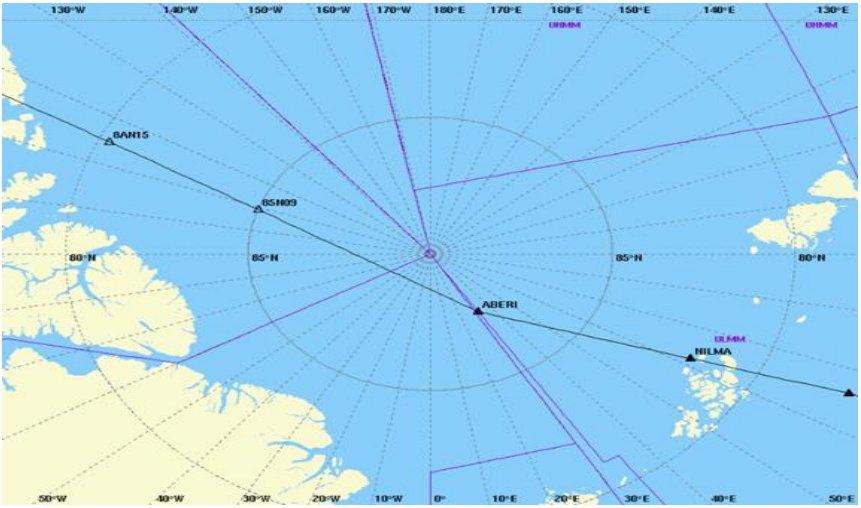
Country	FIR	Code	ADS	CPDLC
Russia	Murmansk Oceanic FIR	ULMM	NO	NO
U.S.A.	Anchorage Arctic FIR	PAZA	NO	YES
Canada	Edmonton FIR	CZEG	YES	YES
Iceland/Greenland	Reykjavik OCA/Sondre Strom FIR	BIRD	YES	YES
Norway	Bodo Oceanic FIR	ENOB	YES	NO

Westbound flights to destinations located on the US West Coast are expected to operate through Russian airspace into the Polar Region and will be dispatched on either one of the two major flows depending on the forecast wind conditions:

- Polar Track 1/ G489 through the Murmansk FIR into Reykjavik FIR
- Fixed ATS routes via the Moscow area through Russia, Random route when leaving the Murmansk FIR starting from the Bodo Oceanic FIR

Due to the prevailing wind conditions, the eastbound flights from the US West Coast will operate on a more Southern route, but may still touch the Polar Region.

Random route structures exist in the Edmonton, Anchorage, Sondre Stromfjord (Reykjavik OCA) and Bodo Oceanic FIRs. Fixed “Cross-Polar” routes have been established within the Russian airspace (Murmansk FIR and Magadan FIR). These cross-polar routes connect mid- and eastern regions of North America with the Asian region via the North Polar Region.



Several “Polar Routes” have been established on the Russian side of the North Polar Region to permit non-stop westbound flights from North America to the Far East Asia referred to as “Polar 1-4”. Of these Polar routes only “Polar 1” (ATS Route G489 shown in the picture above), which is the westernmost route, is normally planned for the EY operations to the U.S. West Coast.

> **Note:** Do not confuse these Polar Routes with the Polar Track System (PTS) and the Arctic Control Area (ACA) tracks linking Western Europe with Alaska over Northern Canada.

When planned through the Northern NAT Region, flights will be dispatched into Canadian airspace on random routes.

Russian Airspace

When operating into Russian airspace anticipate clearance from a RVSM flight level to a Russian metric. Always expect R/T in Russian language being used when ATC communicates with Russian carriers.

In case of diversion into any airport in Russia it is important to remember that the ATC will always issue altimeter setting in QFE. Refer to OM-C for Metric operations.

NavAids in Russia (VORs and NDBs) are sometimes turned off when no traffic is expected. Thus, if a NavAid appears to be off the air, confirm eh status with ATC.

Edmonton FIR

Automatic dependent surveillance waypoint position reporting (ADS WPR) and CPDLC have been implemented in the Edmonton FIR/CTA.

Aircraft are advised that, depending on their position when entering the Edmonton FIR/CTA, initial radio contact will be with either Edmonton ACC (“Edmonton Centre”), Gander international flight service station (“Gander Radio”) or North Bay flight information center (“Arctic Radio”). Communications procedures are outlined below.

Aircraft entering Edmonton ADS airspace without data link connection should ensure their ADS function is turned on and logon using the address CZEG. Logon should be performed between 15 and 45 minutes before entering the airspace. If automatic transfer is unsuccessful, manual logon should be attempted.
Flights exiting the Edmonton data link service area into adjacent airspace where data link services are available should not need to perform another AFN logon. Under normal circumstances, the current and next air traffic service units automatically transfer CPDLC and ADS-C services. The transfer is seamless to flight crew.

Aircraft entering the Edmonton FIR from radar-controlled airspace should not identify themselves as ADS-equipped on initial contact. The term “A–D–S” after the aircraft call sign should only be used leaving radar coverage and approaching the Edmonton ADS airspace. The Edmonton ACC will advise the aircraft that radar service is terminated. This cancellation of radar service should serve to remind ADS-equipped aircraft to commence using the term “A–D–S” in conjunction with their call sign.

The airspace where ADS WPR will be conducted is affected by an area of satellite communication (SATCOM) unreliability. This area, referred to as the SATCOM shadow, extends from the North Pole to 70° N. Unreliability is most pronounced at 120° W where the two satellites servicing the area are furthest away. Coverage improves to the east and west of 120° W where reliable coverage can be expected as far north as 80°N at 80°W.

The exact extent and effect of the shadow depends on atmospheric conditions, aircraft antenna placement, and direction of flight. Aircraft observing an indication that satellite communications have been lost should expect that their ADS reporting has been terminated. Flight crews can re-logon to CZEG if it is felt that the outage has been overcome. Otherwise, ensuing position reports must be provided via voice.

Bodo Oceanic FIR, Reykjavik OCA → *refer to OM-C/Oceanic Operations/North Atlantic*

WEATHER

Polar Region Weather

The North Polar Region includes the ice-covered Arctic Ocean, the Greenland continent and much of Northern Canada and Northern Siberia. Polar climate characterized by persistent cold and relatively narrow annual temperature ranges; winters characterized by continuous darkness, cold and stable weather conditions, and clear skies; summers characterized by continuous daylight, damp and foggy weather, and weak cyclones with rain or snow.

Apart from extreme cold temperatures throughout the year, no particular weather problems exist in the Polar region due to the absence of fronts and jet streams. The climate is moderated by oceanic influences, with regions abutting the Atlantic and Pacific oceans having generally warmer temperatures and heavier snowfalls than the colder and drier interior areas. However, except along its fringe, the Arctic Ocean remains frozen throughout the year.

There is a mass of cold, dense, Arctic air permanently stationed over the North Pole that creates a high-pressure system. This involves an extraordinary inversion of the usual temperature situation, because the air is actually warmer at an altitude of a few hundred metres than it is at ground level. This mass of cold dense air tends to flow southwards as wind, but the wind direction is deviated by the Earth's rotation, meaning that the winds in these high latitudes are predominantly East or North-East.

The lower, Arctic air layer is topped by Polar air that is not quite as cold, and at about 60°N this is surrounded by a belt called the Polar Front, a low-pressure belt generating westerly winds and involving a veritable clash between cold polar air coming down from the Pole and warm tropical air coming up from the Equator.

The Polar Regions are perpetually covered by snow and ice throughout the year. In these high latitude regions of the world, the Sun is never high enough in the sky to cause appreciable melting and the temperature rarely rises above freezing. During the long polar nights, that last six months at the pole, temperatures can fall to extremely low values. Polar climates tend to be dry because the descending air is cold and lacks significant moisture, precluding the formation of clouds and snowfall. Some polar regions receive less than 10 inches or 250 millimeters of precipitation each year.

Great seasonal changes in the length of days and nights are experienced North of the Arctic Circle, with variations that range from 24 hours of constant daylight ("midnight sun") or darkness at the Arctic Circle to six months of daylight or darkness at the North Pole. However, because of the low angle of the sun above the horizon, insolation is minimal throughout the regions, even during the prolonged daylight period. A famous occurrence in the arctic night sky is the 'aurora borealis', or northern lights.

Space Weather

The term 'Space Weather' refers to conditions created on the earth by activity on the surface of the Sun. Solar activity follows an 11 year cycle. The peak period or *solar max* results in a greater number of solar flares or more violent coronal mass ejections (CME). Solar phenomena of interest to us include electromagnetic radiation and Solar Winds.
The sun's electromagnetic radiation spans infrared, visible, and ultraviolet wavelengths and the radio portions, x-rays and beyond. Electromagnetic radiation moves at the speed of light, and begins to affect the Earth's atmosphere around 8 minutes after it leaves the surface of the sun. Increased levels of electromagnetic radiation may 'black-out' the use of radio signals for HF radio communication.

In addition to electromagnetic radiation, the sun constantly ejects clouds of matter in the form of atomic and subatomic particles. The collective term for these gas clouds is the Solar Wind. The Solar Wind normally travels at approximately 400 km/second, so it takes 2-4 days to reach the earth. During periods of increased activity this speed increases, and the strength and direction of the earth's magnetic field is changed.

The polar auroras become larger and more vivid, the ability of the ionosphere to propagate HF radio signals is reduced, GPS navigation accuracy may be reduced and radiation levels may increase beyond recommended human dosage levels. Due to the shape of the earth's magnetic field, these changes are concentrated and most noticeable in the Polar Regions.

Space Weather Monitoring and Alerting

The National Oceanic and Atmospheric Administration's (NOAA) Space Environment Center (SEC) operates a worldwide network of sensors, which continuously observe conditions between the earth and the sun.

Updated every three-hours beginning at 0000 UTC, Geophysical Alert Broadcasts are concerned with both electromagnetic and solar radiation.
The NOAA website *http://www.sec.noaa.gov/SWN/index.html* provides real-time information on space weather. Forecast space weather is provided at *http://www.sec.noaa.gov/forecast.html*.

Cosmic Radiation Exposure

Galactic cosmic radiation (GCR) emanates from outside the solar system. Occasionally a disturbance in the sun's atmosphere leads to a surge in radiation particles. Protection is provided by three influences, the sun's magnetic field, the earth's magnetic field, and the earth's atmosphere. Exposure rates are dependent on altitude, latitude and the solar

cycle. Exposure rates increase at higher altitudes and higher latitudes up to 55°N (geomagnetic knee).

Human radiation dose levels are measured in Millisieverts (mSv) which are used to place all of the radiation types on an 'equivalent' basis with respect to the biological effect. The maximum regulatory annual dosage established by GCAA is 6 mSv. Etihad Airways applies a limit of 5.

Etihad Dispatch continually monitors solar activity and adjusts flight routings to avoid cosmic radiation that exceeds certain limits.

Solar activities occur at fairly regular frequencies and are monitored by the National Oceanic and Atmospheric Administration (NOAA) if the United States. These activities, rated on scales designed by NOAA, which are of interest to commercial airlines, are:

Geomagnetic Radiation

Geomagnetic radiation generally affects the accuracy of the GPS navigation system and is rated as:

G1 – Minor. Minor impact on satellite operations possible.
G2 – Moderate Possible errors.
G3 – Strong Intermittent satellite navigation problems may occur. Position errors likely.
G4 – Severe Satellite navigation degraded for hours. Increased errors.
G5 – Extreme Satellite navigation may be degraded for days. Major position errors.

Solar Radiation

Solar radiation affects humans physiologically and is rated as:

S1 – Minor No effects. Small effect on high frequency (HF) radio in polar region.
S2 – Moderate No effects. Infrequent satellite event upsets, slight effect to polar cap HF.
S3 – Strong Passengers and crew in commercial jets at high latitudes may receive low level radiation exposure. Damage to exposed satellite components, degraded HF at polar cap.
S4 – Severe Elevated radiation exposure to passengers and crew in commercial jets at high latitude is possible. Satellite star tracker orientation problems, blackout of HF radio at polar cap for several days.
S5 – Extreme High radiation exposure to passengers and crew in commercial jets at high latitude is possible. Loss of some satellites, no high frequency (HF) communications in Polar Regions.

Electromagnetic radiation

Electromagnetic radiation generally affects the HF communications and is rates as:

R1 – Minor Weak or minor degradation of HF radio communication, occasional loss of radio contact
R2 – Moderate. Limited blackout of HF communication on sunlit side, loss of radio contact for 10 minutes
R3 – Strong Wide area blackout of HF radio communication, loss of radio contact for about an hour on the sunlit side of the Earth
R4 – Severe HF communication blackout on most of the sunlit side of the Earth for 1 to 2 hours.

R5 – Extreme Complete HF radio blackout on the entire sunlit side of the Earth lasting for a number of hours.

Polar Restrictions

Polar flights may be affected by increased activity on the surface of the sun. Items of particular interest are the reduction or complete loss of HF radio communications, the degradation of GPS accuracy and the exposure of passengers and crew to higher than normal levels of radiation. Flights over the polar area may have to be rerouted or even curtailed until conditions improve.

Radio Blackout Scale

- **No flights may operate on polar routes if Solar Radiation, Radio Blackout or Geomagnetic Storm activity is at level 4 or 5.**
- **Radio blackout level 2 (R2) or 3 (R3) will require a non-polar routing.**

Space Weather Monitoring and Inflight Strategy

In addition to providing crew with a radiation forecast, Flight Dispatch regularly monitors space weather activity through NOAA's Space Environment Center based in Boulder, Colorado.

Space weather activity forecast are usually accurate for up to a week.
In the unlikely event of an unanticipated Solar radiation Activity exceeding level S2 while enroute, NOC will alert the crew. Since a re-route in the Polar region is not probable, descending to a lower cruising flight level is recommended.
Solar radiation at level 3 (S3) will require Polar flights to be conducted at FL310 or below.
The effects of Solar Radiation are attenuated rapidly with decreasing altitude below 50.000 feet. Descending to FL 310 or lower increases the layer of atmosphere that acts as a shield above the aircraft thereby reducing as much as possible, the exposure to radiation.

Crew may also elect to increase cruising speed as an added measure to reduce exposure time.

7CREW OPERATING PROCEDURES

Dispatch

At the Briefing Center, crew will be provided with the Solar Activity forecast and Fuel Temperature Prediction Charts in addition to the usual documents necessary for the flight.

The LIDO flight planning system will normally select the optimum route for the flight. If a Polar Route is selected, Flight Dispatch will check for any conditions e.g. radiation forecast, cold air, or availability of enroute alternates that may preclude its use. In such an event, a non-polar route will be used.

- **No flights may operate on Polar Routes if the Solar Radiation, Electromagnetic Radiation or Geomagnetic Radiation activity is at level 4 or 5.**
- **If the Solar Radiation is at level 3, Polar flights will be planned to operate at FL 310 or below.**

Polar Routes

Due to the lack of ATC flexibility, planned routes should be flown as filed. The ATC system of Russia generally does not allow direct routing or a change of route.

A route shall be planned such that the aircraft will, when in the Polar Region, be within a maximum diversion time of:

- A340: 240 minutes, at a one-engine inoperative cruise speed of 475 Knots TAS, from any available enroute alternate.

Polar Navigation

IRS alignment (if necessary)

Airbus

- When a high latitude or Polar flight is planned:
  - Delay the completion of IRS alignment as long as possible
  - Prior to pressing the ALIGN IRS prompt, change the origin airport reference coordinates to the gate coordinates, if published. Coordinates must be cross-checked by both pilots.

- When the origin airport is located between latitude 73^0N and 82^0N, IRS alignment will take at least 15 minutes.Consequently:
  - Set IRS selector NAV
  - Start the stopwatch
  - Change the airport coordinates to the gate coordinates, if published, on the INIT A page. Coordinates must be cross-checked by both pilots.
  - Press the ALIGN IRS prompt after the 15 minutes or more of alignment time

  Note: Beyond 82^0 North or South, ADIRS alignment is not possible.

- When tracks are referenced to TRUE, select TRUE by pressing the NORTH REF pushbutton. The TRU labels are displayed above the PFD and ND heading scales, and the GRID TRACK appears on the ND in all modes except in PLAN mode if no approach title is displayed. TRUE NORTH REF is displayed on ECAM MEMO. In addition:

  - If NAV mode is engaged, there is no discontinuity in the lateral guidance.
  - If HDG (TRK) modes are engaged, the HDG (TRL) target is automatically modified using current position magnetic variation; thus there is no discontinuity in lateral guidance.
  - If the NORTH REF is not manually selected, and as the aircraft continues north of latitude 82^0 30'N, the IRSs automatically revert from MAG to TRUE. When this occurs, an amber caution message is triggered on the ECAM:

    NAV EXTREME LATITUDE
    NORTH REF……...TRUE

    The autopilot may disengage and an amber caution HDG DISCREPANCY (associated with a CHECK HDG message on PFD and ND) may be triggered. This occurs as a result of the 3 IRSs not entering the Polar Region simultaneously.

Press the NORTH REF pushbutton to select TRUE and re-engage the autopilot if disengaged.

- Avoid flying directly over the North Pole (coded NPOLE in the FMGS database) due to the possibility of aggressive autopilot maneuvers when the heading changes 180^0 from North to South.
- GPS position updating is not available north of Latitude $88^0$30'N due to the loss of GPS coverage. As a result, minor map shifts may occur.
- When leaving the Area of Magnetic Unreliability or when tracks are referenced to MAG. Deselect NORTH REF pushbutton to return to MAG reference.

If the NORTH REF is not manually deselected and the aircraft continues south of $82^0$30'N, the IRSs automatically revert from TRUE to MAG. The amber ECAM message CHECK NORTH REF will be displayed on the ND. The autopilot may disengage and an amber caution HDG DISCREPANCY (associated with a CHECK HDG message on the PFD and ND) may be triggered. Deselect the NORTH REF pushbutton and re-engage the autopilot if disengaged.

ADF and VOR bearing display (Refer to FCOM DSC 31.40)

- The ADF needle represents the relative bearing between the aircraft and the NDB. The ADF relative bearing information is thus dependent on the TRUE/MAG selection and the needle is always pointing to the transmitting station whatever is the selection.

- The VOR bearing is measured by the VOR at the VOR stations. Therefore:
  - It is a TRUE bearing if the VOR transmitter is referenced to TRUE
  - It is a MAG bearing if the VOR transmitter is reference to MAG.

Communications

VHF, HF and CPDLC

Continuous communication coverage is normally available using VHF and HF while operating in the North Polar Region.
ARINC also provides Polar Region long range HF using a transmitter at Barrow, Alaska.

If HF radio communications with Gander are difficult, Polar flights may call Edmonton Center at 001 (780) 890-8230 using SATCOM and speak directly to the Polar Controller.
On the Russian side of the Arctic Ocean, ATC on ATS route G489 (Polar 1) and south is provided by Murmansk OACC using VHF and HF. CPDLC is not implemented yet.

Crossing the Russian boundary without radio communication is prohibited except for the cases when the radio communication failure occurred in flight with the aircraft being under direct control of an ATC unit of Russia or upon receiving the ATC clearance to enter Russian airspace.

In the event of communication failure while in compliance with IFR procedure, the aircraft shall proceed to the destination aerodrome in accordance with the flight plan.

During periods of increased solar flare activity there may be a reduction or loss of HF capability. Flights will not be planned through areas of moderate or greater solar flare activity if this is known to flight dispatch at the time of planning, therefore HF communications should not be degraded.

Russian ATC HF facilities normally show at least two frequencies. The unused frequency may not be monitored.
Murmansk ACC has SELCAL capabilities, while other Russian HF stations may not be equipped with SELCAL. When no SELCAL is available, a listening watch is required on HF frequencies assigned by ATC.

VHF is available within 200NM of the Russian 'coast', where 'domestic' communication is resumed. Expect to give estimates for entry points.

Note: Use standard phraseology when communicating with Air Traffic Controllers in Russia.

In case of communications failure within Murmansk OCA pilots shall try to establish communication with Magadan OAC in order to make a position report.

For Murmansk OCA:
HF communications on designated frequencies: 11390 kHz (primary), 8950 kHz (secondary), 5694kHz, 4672kHz.

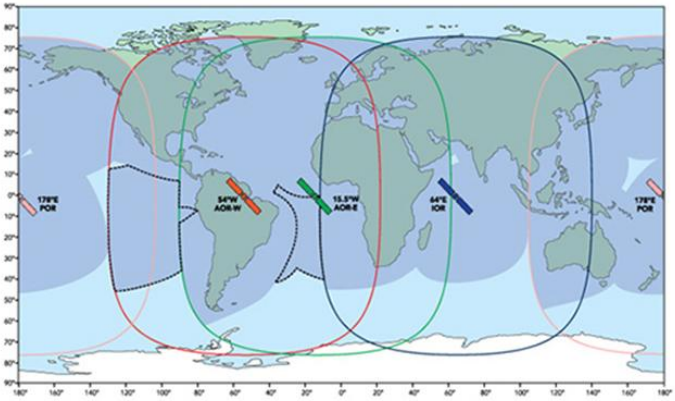
For Magadan OCA:
HF communications on designated frequencies: 11390 kHz (primary), 8837 kHz (secondary); CPDLC channel of Magadan OAC for FANS equipped aircraft. CPDLC address GDXB.

Arctic Radio, controlled from North Bay, provides VHF coverage throughout the Canadian Arctic between 63^0 N and 80^0 N.
An HF transmitter at Cambridge Bay, which is also controlled by Arctic Radio, allows long range communication with Edmonton ATC.

SATCOM

SATCOM is available south of up to 82°N with CPDLC also available in certain ACC's. Also, within the FIRs of Anchorage and Edmonton further areas of SATCOM shadows exist.

Satellite AIRCOM coverage



Company Communications

Communications between the aircraft and NOC shall be accomplished using the following systems priority:

1. SATCOM voice
2. ACARS – ACARS communications between aircraft and ground systems is achieved via the VHF, SATCOM and HF Datalink. The selection is automatic.
3. HF Phone patch – Using the appropriate HF frequency and depending on the location of the aircraft, establish contact with Stockholm , Berna or Portishead Radio and request for a phone patch service.

Note <u>When operating at high latitudes, ACARS communications are transmitted using the HF Data link system. In order for it to function, crew shall ensure that HF 1 is selected to the data mode before entering the Polar area.</u>

Fuel Temperature information

Fuel freeze point

Engine manufacturers specify a minimum fuel temperature for the fuel to enter the engine. This may be expressed as Fuel Freezing Point plus a margin. For the Trent 553 engines fitted on the A340-500/600 aircraft, the margin is specified as zero. Therefore, for the Trent 553 powered A340-500/600, the Minimum Fuel Temperature is the Fuel Freeze Point.
If the Actual Fuel Freeze Point (determined by the fuel analysis procedure) of the fuel used for the flight is not known, the following Fuel Specification Freeze Points should be used:

- JET A1…….. - 47^{0}C (Fuel supplied in AUH)
- JET A…… -40^{0}C (Fuel supplied in LAX)
- TS-1 or RT…… -50^{0}C (Fuel supplied in Russia)

Note: The Fuel Freeze Point is defined as the temperature at which wax crystals, which form in the fuel as it cools, completely disappear when fuel is re-warmed.

The Actual Fuel Freeze Point in most instances is considerably lower than the published Fuel Specification Freezing Point and is determined by using a fuel analysis program.

The procedure for the fuel analysis program essentially uses the Laboratory test report for each fuel stock delivered to determine the Actual Fuel Freeze Point.
The Actual Fuel freeze Points will be used for that load of uplifted fuel.

Note: Last minute additional fuel uplifts need not to be analyzed for the Actual Fuel Freeze Point as this quantity is proportionally small and therefore has a negligible effect on the overall fuel load.

Typically, the Actual Fuel Freeze Point of Jet A fuel averages a few degrees below the Specific Fuel Freeze Point.

A fuel analysis procedure is normally performed when a flight uses the Polar Routes.

Note: if the fuel analysis was not performed, the minimum fuel temperature for the flight is limited to the Fuel Specification Freeze Point for the type of fuel uplifted.

Note: if the fuel analysis was performed but the crew has not received the result of the analysis at departure time, the flight may depart provided the minimum fuel temperature is limited to the Fuel Specification Freeze Point until the result is relayed to the crew via ACARS.

A fuel analysis procedure is not required when fuel JET A1 is uplifted, as it has a lower freezing point of -47^0 C and is therefore not critical for Trans-Polar flights.

The Fuel Temperature Prediction Chart provides the crew a preview of the predicted fuel temperature for the flight. A predicted fuel temperature for each tank is indicated at each waypoint. Airbus' Fuel Temperature Prediction Program generates these charts by taking into account the fuel temperature at departure, volume of fuel in each tank and the forecast OAT and TAT along the route. The following is a sample of the chart:

```
OUTPUT FROM FUEL TEMPERATURE PREDICTION (FTP) FOR A380
******************************************************
SUMMARY OF OUTPUTS
NO FUEL FREEZING ISSUES ENCOUNTERED THIS MISSION
NO FUEL TEMPERATURE WARNINGS ENCOUNTERED

NORMAL FUEL MANAGEMENT

MINIMUM OAT OF  -73.0 OCCURRED AT WAYPOINT  GALTU

MINIMUM TEMPERATURES OF TANKS
TANK  TEMPERATURE  WAYPOINT
LOT    -37.7        6740N
FT1    -34.5        6730N
LMT    -13.8        BA
FT2    -27.5        TOD
LIT     14.0        VEDOM
TT     -16.9        GRIBS
```

Waypt	Time	Alt	Dist	Mach	Temperatures								Advisory Flags		
	min	feet	nm	no	OAT	TAT	LOT	FT1	LMT	FT2	LIT	TT	FOB	OTR	FT1	Trim
START FOB	600 kg of fuel used for taxi /climb prior to start mission.												167545			
OMAA	0	0	0	0.37	24.0	31.4	15.0	15.0	15.0	15.0	15.0	15.0	167424	0	0	0
TUMAK	24	36000	159	0.85	-47.0	-17.8	14.0	14.3	14.5	14.9	14.6	14.8	158349	0	0	0
VEDOM	28	36000	192	0.85	-47.0	-17.8	13.0	13.6	14.0	14.7	14.0	14.6	157549	0	0	0
VELAK	32	36000	226	0.85	-47.0	-17.8	12.0	12.9	13.5	14.4		14.3	156649	0	0	0
ALTOM	35	36000	253	0.85	-47.0	-17.8	11.2	12.4	13.2	14.2		14.2	155849	0	0	0
DURSI	43	37000	303	0.85	-49.0	-20.0	9.3	11.1	12.2	13.7		13.7	154449	0	0	0
KATAG	52	37000	376	0.85	-50.0	-21.1	7.1	9.5	11.1	13.0		13.2	152549	0	0	0
LAGSA	53	37000	382	0.85	-50.0	-21.1	6.9	9.3	11.0	12.9		13.1	152349	0	0	0
ASNIT	70	36000	520	0.85	-50.0	-21.1	3.2	6.4	9.0	11.9		12.1	148749	0	0	0
OBTUX	76	36000	569	0.85	-51.0	-22.2	2.0	5.6	8.3	11.3		11.7	147549	0	0	0
LOXAK	79	36000	594	0.85	-51.0	-22.2	1.4	5.1	7.9	11.1		11.5	146849	0	0	0
EGPAT	86	36000	648	0.85	-52.0	-23.4	0.0	3.9	7.1	10.6		11.1	145649	0	0	0
PEKAM	94	36000	710	0.85	-54.0	-25.6	-1.6	2.6	6.1	10.1		10.6	143849	0	0	0
EGVEL	104	36000	791	0.85	-54.0	-25.6	-3.6	1.2	4.9	9.1		9.9	141849	0	0	0

Crew are required to record the temperature of the coldest fuel at convenient waypoints of 30-minute intervals within the route segment 2 hours prior to entering the Polar Region and 2 hours after leaving the Polar Region. These values shall be annotated in the space adjacent to the predicted fuel temperature of the affected tank.

Cold Fuel Management Procedure

During the winter months, areas with Outside Air Temperatures of -68^0 C are common in the Polar Region thus creating a potential for fuel temperatures to approach the fuel freeze point. Whenever possible, a Polar Route that avoids these cold areas will be selected.

When the fuel temperature in any cold tank cools to below -40^0 C, the ECAM warning FUEL LO TEMP will be triggered, accompanied by ECAM actions. In addition the fuel temperature indication on the ECAM Fuel page turns amber.

The ECAM Actions must be accomplished if:

- Jet A fuel is used and the fuel analysis (to determine the Actual Fuel Freeze Point) was not performed.
- A fuel analysis was performed but the crew has not received the result of the analysis.

The ECAM Actions shall be deferred if:

- Jet A1 fuel is used
- Jet A fuel is used and the fuel analysis has determined that the Actual Fuel Freeze Point is below -40^0 C.

Clear the ECAM warning.

> **Note:** When cleared, the FUEL LO TEMP ECAM warning will automatically be recalled if the temperature cools further to -47^0 C

In this condition, crew should heighten their awareness of the fuel temperature to ensure that it does not exceed the Actual Fuel Freeze Point. However, this added vigilance should not cause the crew to be distracted from their overall responsibility towards the safety of the flight.

If the fuel continues to cool and the temperature approaches the Actual Fuel freeze Point, crew may attempt to stop or reduce the rate of cooling by increasing the TAT.

Since obtaining clearance to change a route is difficult in the Russian airspace, changing altitude is an easier option. Generally, descending to a lower altitude raises the TAT.

> **Note:** Warmer air can sometimes be found at altitudes above the Tropopause. In that case, a climb to a higher altitude may be warranted.

Crew may also attempt to increase the TAT by increasing speed. An increase of 0.01 Mach results in a TAT increase of 0.5 to 0.7^0 C.

In some instances, a descent to lower altitude together with an increase in speed may be required to increase the TAT.

> **Note:** Fuel tends to cool quickly and warm slowly. It may take between 15 minutes and 1 hour before the effects of an increase in TAT can be noticed.

> **Note:** These techniques to increase TAT may increase fuel consumption to a point where a refueling stop may become necessary.

If attempts to prevent further cooling of the fuel are unsuccessful and the fuel temperature reaches the Actual Fuel Freeze Point (or -47^0 C if Jet A1 fuel is used), the ECAM actions for FUEL LO TEMP must be accomplished.

If not automatically recalled, press the RECALL Push-button at the ECAM control panel to recall the ECAM actions for FUEL LO TEMP and complete the actions accordingly.

> **Note**: Since the Fuel Freeze Point is defined as the temperature at which the last wax crystal melts, the fuel will not complete solidify at temperature. The critical condition of cold fuel is its ability to flow. The lowest temperature at which fuel still flows before turning into a semi-rigid state is called the Pour

Point. Although the Pour Point is not routinely analyzed it is typically 6^0 C lower than the Fuel Freeze Point.

Enroute diversion

A diversion to any airport s in the Polar region or Northern Russia should be consider only in the event of an extremely serious aircraft emergency, e.g. uncontrollable fire or an impending airframe failure. While these airports are adequate for landing, they are generally inadequate in terms of passengers handling, aircraft handling and maintenance.

During the winter months, severe weather conditions with extremely low temperatures and strong winds can be expected at these airports. In addition, the medical facilities there may not be adequately equipped to manage life-threatening illnesses.
In the event of an inflight medical emergency and there is no doctor or medical personnel on board, crew can seek medical advice from Medlink. Medlink can be contacted by SATCOM or making a HF phone patch.

If a doctor or medical personnel on board recommends expeditious hospitalization for the patient, the Commander shall contact Medlink for further consultation and concurrence.
The decision to divert to a remote airport for a medical emergency lies solely with the Commander who has to take into consideration the safety of the flight, suitability of the enroute alternate, the prevailing weather conditions and the nature of the medical emergency. A careful evaluation of the situation is necessary.

The rudimentary ground support and/or severe weather conditions at a remote alternate airport may result in the aircraft being stranded for many hours or even days.
Conditions permitting, an alternate airport listed in the table below as Category “Enroute Alternate airport” rather than “Emergency Airport” is preferred (refer to section “Enroute Alternates” below). Crew should inform NOC stating the intention to divert, as soon as practicable.

If the diversion is to an airport in Russia, be prepared to apply the Metric Altimeter Operations (Ref. OM-C/Skybook).

Recovery operations

A very important aspect of any diversion to an airport in a remote region is the safety and protection of the passengers and the recovery operation. The efficiency of the recovery operations will depend on a large part on the crew’s ability to establish communications with NOC. Employ all available means to establish contact with NOC as soon as practicable after landing.

Global Avia, a company contracted to provide English-speaking personnel to assist the crew should a flight divert to any airport in North and Far East Russia, will be alerted as soon as NOC is informed of an intention to divert.
Depending on the location, it may require approximately 18 hours for a relief flight to reach the remote alternate. Several stations have been identified as points for the mounting of relief flights:

- Beijing and Seoul - For diversions to Northern Russia
- Any Northern European EY station - For diversions to North Scandinavia
- Any Northern US EY station - For diversions to North Canada

The Commander, with the assistance of the cabin crew and the contracted local agent, shall ensure that all the necessary has been accomplished to ensure the safety and comfort of the passengers and crew.

The Commander shall endeavor to remain in close communication with NOC, who will coordinate the recovery efforts.

> **Note**: The SATCOM VOICE function requires the IRSs / ADIRU to remain in the align mode. Do not turn the IRSs / ADIRU off.

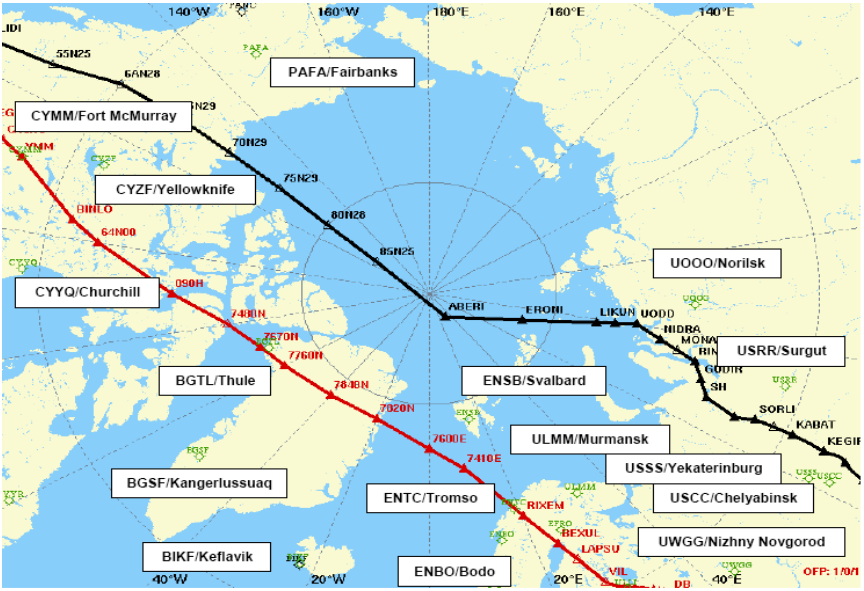
If an extraordinary cold condition exists at the alternate and a lengthy stop is anticipated, crew shall ensure that the aircraft is safely secured (Refer to FCOM/PRO-SOP-91-30).

ENROUTE ALTERNATES

For the purpose of Trans Polar Operations, the enroute alternate airports are categorized in 2 categories, Enroute alternate and Emergency.
Note for Thule airport (BGTL/THU): Runway, VOR and ILS are referenced to the True North

ICAO/IATA	Airport Name	Lat/Long	RFF	RWY	Longest RWY (m)	APCH	Use for:
BGSF/SFJ	Kangerlussuaq Sondre Stromfjord	N6701.0 W05041.4	CAT 5 * CAT 8 4HR PN	10/28	2810	MKR LOC	Emergency
BGTL/THU Airport with runway, VOR and ILS referenced to True North	Thule	N7631.9 W06842.2	CAT 7	08/26	3048	ILS	Emergency
BIKF/KEF	Keflavik	N6359.1 W02236.3	CAT 9	11/29	3065	CAT II	En-route Alternate
CYEG/YEG	Edmonton	N5318.6 W11334.8	CAT 8	02/20	3353	ILS	En-route Alternate
CYFB/YFB	Iqaluit Frobisher Bay	N6345.6 W06833.3	CAT 5 (OPS Hours)	17/35	2621	ILS	Emergency
CYMM/YMM	Fort McMurray	N5639.2 W11113.6	CAT 6	07/25	2286	ILS	Emergency
CYVR/ YVR	Vancouver	N4911.7 W12311.0	CAT 9	08R/ 26L	3506	CAT II	En-route Alternate
CYWG/ YWG	Winnipeg	N4954.6 W09714.4	CAT 7 (CAT 8 24HR PN)	18/ 36	3653	CAT II	En-route Alternate
CYXE/ YXE	Saskatoon	N5210.3 W10642.0	CAT 7	09/27	2530	ILS	Emergency
CYXY/ YXY	Whitehorse	N6042.6 W13504.0	CAT 7	14R/32L	2896	ILS	En-route Alternate
CYYQ/YYQ	Churchill	N5844.2 W09403.4	CAT 4	15/33	2804	ILS	Emergency
CYZF/YZF	Yellowknife	N6227.8 W11426.6	CAT 6	15/33	2286	ILS	Emergency
EFRO/RVN	Rovaniemi	N6633.7 E02549.9	CAT 7	03/21	3002	CAT II	En-route Alternate
ENBO/BOO	Bodo	N6716.2 E01421.9	CAT 6	07/25	2528	ILS	Emergency

ENSB/LYR	Svalbard Longyear	N7814.8 E01527.9	CAT 4 (CAT 7 PN)	10/28	2483	ILS	Emergency
ENTC/TOS	Tromso	N6940.9 E01855.1	CAT 7	01/19	2392	ILS	En-route Alternate
PAFA/FAI	Fairbanks Intl.	N6448.8 W14751.6	CAT 6/7	01L/19R	3597	CAT II	En-route Alternate
PANC/ ANC	Anchorage	N6110.4 W14959.9	CAT 9	07R/ 25L	3230	CAT III	En-route Alternate
ULLI/LED	St.Petersburg	N5948.0 E03015.9	CAT 8	10R/28L	3780	CAT II	En-route Alternate
ULMM/MMK	Murmansk	N6846.9 E03244.8	CAT 7	14/32	2500	ILS	En-route Alternate
UNNT/OVB	Novosibirsk	N5500.7 E08239.1	CAT 8	07/25	3600	CAT II	En-route Alternate
UOOO/NSK	Norilsk	N6918.6 E08720.0	CAT 8	01/19	3430	ILS	En-route Alternate
USCC/CEK	Chelyabinsk	N5518.3 E06130.3	CAT 8	09/27	3200	ILS	En-route Alternate
USRR/SGO	Surgut	N6120.6 E07324.2	CAT 7	07/25	2790	ILS	En-route Alternate
UUDD/DME	Moscow Domodedovo	N5524.5 E03754.5	CAT 8	14L/32R	3749	CAT II	En-route Alternate
UUEE/SVO	Moscow Sheretmetyevo	N5558.3 E03724.9	CAT 8	07R/25L	3700	CAT II	En-route Alternate
UWGG/GOJ	Nizhny Novgorod	N5613.8 E04347.0	CAT 7	18R/36L	2805	ILS	En-route Alternate



SEARCH AND RESCUE (SAR)

General
SAR efforts in the far north in extreme weather conditions have limited prospects for success. The key to improving the probability of a favorable outcome in search and rescue operations is the prompt notification by the crew to ATC.

Alaska and Western Arctic
The U.S. Coast Guard Rescue Coordination Center (RCC) at Juneau, Alaska, coordinates SAR from Alaska to the Pole and South on the Russian side of the Pole as far West as 100^0 E to within 12 nm of the Russian coastline. The Coast Guard has an agreement with the Russian RCC in Vladivostok to assist the Russian SAR efforts with U.S. SAR resources from Nome and Anchorage. A Russian representative is attached to the Coast Guard in Juneau for liaison purposes and is on call 24 hours.

In an emergency, the Coast Guard will provide all available assistance. Several large Coast Guard and Air Force aircraft are available in the Anchorage area for SAR efforts.

Canada
SAR service in Canada is available in Canadian airspace as far north as the North Pole.

Russia
Russia provides SAR service only within the radius of operations of search and rescue aircraft based at airports in the Russian Far North. This coverage does not extend to the North Pole. The U.S. Coast Guard can provide additional SAR resources in the event of an emergency situation in Northern Russia.

AIRCRAFT SYSTEMS
The minimum equipment required on the aircraft for Polar Operations are:

1. 1 arctic suit per each operating crew member
2. At least 1 automated external defibrillator (AED)
3. A Fuel Quantity Indication System (including the fuel temperature indication system)
4. Auto-Thrust system
5. Communication system appropriate for the route to be flown

If any of the required equipment for Polar Operations is not available or unserviceable and cannot be rectified prior to departure, a non-Polar Route shall be planned. Refer to MEL for details.

Contingencies

All Fuel Temperature Indications must be serviceable prior to undertaking a Polar flight.

If a fuel temperature sensor becomes unserviceable inflight, pilots shall consider the lowest of the remaining fuel temperature indications as the most limiting one.

POLAR OPERATIONS

BACKGROUND

The weather and wind patterns over the Polar Region, during certain periods of the year, makes the use of great circle routes over the North Pole the most efficient routes for flights between North America and the Middle East.
A flight is considered to be operating in the North Pole Region when flying north of Latitude 78^0 North.

GENERAL

While the Polar Region provides the most efficient routes, they traverse some of the harshest landscapes and atmospheric environments. These present different challenges and require added considerations.

The areas of particular concern when operating in the Polar Region are:

- Effects of radiation from solar activity
- Polar navigation and communications
- Fuel freeze point and cold fuel management
- In-flight diversion and en-route alternates

Detailed procedures and operating techniques may be found in the relevant sections of the Operation Manuals (OM-A, OM-B, OM-C). Route and communication information can be found in the Jeppesen reference Manual and relevant Jeppesen charts.

FLIGHT PLANNING

A "Polar Plotting Chart" is provided with the briefing documents for the flights operating through the Polar Region. The chart must be returned with the flight envelope. A spare Polar Orientation Chart shall be collected at the Briefing Center and left in the envelope if not used.

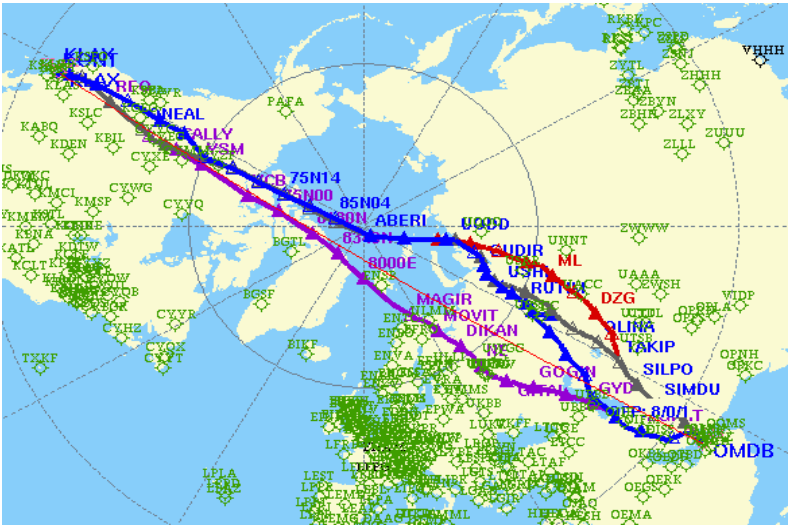
Affected FIRs in the Polar Region

Country	FIR	Code	ADS	CPDLC
Russia	Murmansk Oceanic FIR	ULMM	NO	NO
U.S.A.	Anchorage Arctic FIR	PAZA	NO	YES
Canada	Edmonton FIR	CZEG	YES	YES
Iceland/Greenland	Reykjavik OCA/Sondre Strom FIR	BIRD	YES	YES
Norway	Bodo Oceanic FIR	ENOB	YES	NO

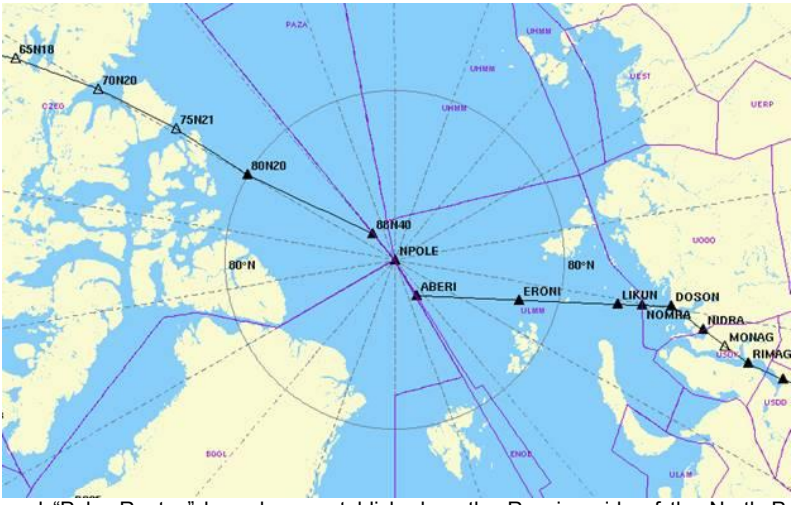
Westbound flights to destinations located on the US West Coast are expected to operate through Russian airspace into the Polar Region and will be dispatched on either one of the two major flows depending on the forecast wind conditions:

- Polar Track 1/ G489 through the Murmansk FIR into Reykjavik FIR
- Fixed ATS routes via the Moscow area through Russia, Random route when leaving the Murmansk FIR starting from the Bodo Oceanic FIR

Due to the prevailing wind conditions, the eastbound flights from the US West Coast will operate on a more Southern route, but may still touch the Polar Region.



Random route structures exist in the Edmonton, Anchorage, Sondre Stromfjord (Reykjavik OCA) and Bodo Oceanic FIRs. Fixed “Cross-Polar” routes have been established within the Russian airspace (Murmansk FIR and Magadan FIR). These cross-polar routes connect mid- and eastern regions of North America with the Asian region via the North Polar Region.



Several “Polar Routes” have been established on the Russian side of the North Polar Region to permit non-stop westbound flights from North America to Far East Asia referred to as “Polar 1-4”. Of these Polar routes only “Polar 1” (ATS Route G489 shown in the

picture above), which is the westernmost route, may be planned for the EY operations to the U.S. West Coast.

Note: Do not confuse these Polar Routes with the Polar Track System (PTS) and the Arctic Control Area (ACA) tracks linking Western Europe with Alaska over Northern Canada.

When planned through the Northern NAT Region, flights will be dispatched into Canadian airspace on random routes.

Russian Airspace

Always expect R/T in Russian language being used when ATC communicates with Russian carriers.

In case of diversion into any airport in Russia it is important to remember that the ATC will always issue altimeter setting in QFE. Refer to OM-C for Metric operations.

NavAids in Russia (VORs and NDBs) are sometimes turned off when no traffic is expected. Thus, if a NavAid appears to be off the air, confirm the status with ATC.

Edmonton FIR

Automatic dependent surveillance waypoint position reporting (ADS WPR) has been implemented in the Edmonton FIR/CTA.

Aircraft are advised that, depending on their position when entering the Edmonton FIR/CTA, initial radio contact will be with either Edmonton ACC (“Edmonton Centre”), Gander international flight service station (“Gander Radio”) or North Bay flight information center (“Arctic Radio”). Communications procedures are outlined below.

Aircraft entering Edmonton ADS airspace without data link connection should ensure their ADS function is turned on and logon using the address CZEG. Logon should be performed between 15 and 45 minutes before entering the airspace. If automatic transfer is unsuccessful, manual logon should be attempted.

Flights exiting the Edmonton data link service area into adjacent airspace where data link services are available should not need to perform another AFN logon. Under normal circumstances, the current and next air traffic service units automatically transfer CPDLC and ADS-C services. The transfer is seamless to flight crew

Aircraft entering the Edmonton FIR from radar-controlled airspace should not identify themselves as ADS-equipped on initial contact. The term “A–D–S” after the aircraft call sign should only be used leaving radar coverage and approaching the Edmonton ADS airspace. The Edmonton ACC will advise the aircraft that radar service is terminated. This cancellation of radar service should serve to remind ADS-equipped aircraft to commence using the term “A–D–S” in conjunction with their call sign.

The airspace where ADS WPR will be conducted is affected by an area of satellite communication (SATCOM) unreliability. This area, referred to as the SATCOM shadow, extends from the North Pole to 70° N. Unreliability is most pronounced at 120° W where the two satellites servicing the area are furthest away. Coverage improves to the east and west of 120° W where reliable coverage can be expected as far north as 80°N at 80°W.

The exact extent and effect of the shadow depends on atmospheric conditions, aircraft antenna placement, and direction of flight. Aircraft observing an indication that satellite communications have been lost should expect that their ADS reporting has been terminated. Flight crews can re-logon to CZEG if it is felt that the outage has been overcome. Otherwise, ensuing position reports must be provided via voice.

Bodo Oceanic FIR, Reykjavik OCA → *refer to OM-C/Oceanic Operations/North Atlantic*

WEATHER

The North Polar Region includes the ice-covered Arctic Ocean, the Greenland continent and much of Northern Canada and Northern Siberia. Polar climate characterized by persistent cold and relatively narrow annual temperature ranges; winters characterized by continuous darkness, cold and stable weather conditions, and clear skies; summers characterized by continuous daylight, damp and foggy weather, and weak cyclones with rain or snow.

Apart from extreme cold temperatures throughout the year, no particular weather problems exist in the Polar region due to the absence of fronts and jet streams. The climate is moderated by oceanic influences, with regions abutting the Atlantic and Pacific oceans having generally warmer temperatures and heavier snowfalls than the colder and drier interior areas. However, except along its fringe, the Arctic Ocean remains frozen throughout the year.

There is a mass of cold, dense, Arctic air permanently stationed over the North Pole that creates a high-pressure system. This involves an extraordinary inversion of the usual temperature situation, because the air is actually warmer at an altitude of a few hundred metres than it is at ground level. This mass of cold dense air tends to flow southwards as wind, but the wind direction is deviated by the Earth's rotation, meaning that the winds in these high latitudes are predominantly East or North-East.

The lower, Arctic air layer is topped by Polar air that is not quite as cold, and at about 60°N this is surrounded by a belt called the Polar Front, a low-pressure belt generating westerly winds and involving a veritable clash between cold polar air coming down from the Pole and warm tropical air coming up from the Equator.

The Polar Regions are perpetually covered by snow and ice throughout the year. In these high latitude regions of the world, the Sun is never high enough in the sky to cause appreciable melting and the temperature rarely rises above freezing. During the long polar nights, that last six months at the pole, temperatures can fall to extremely low values. Polar climates tend to be dry because the descending air is cold and lacks significant moisture, precluding the formation of clouds and snowfall. Some polar regions receive less than 10 inches or 250 millimeters of precipitation each year.

Great seasonal changes in the length of days and nights are experienced N of the Arctic Circle, with variations that range from 24 hours of constant daylight ("midnight sun") or darkness at the Arctic Circle to six months of daylight or darkness at the North Pole. However, because of the low angle of the sun above the horizon, insolation is minimal throughout the regions, even during the prolonged daylight period. A famous occurrence in the arctic night sky is the 'aurora borealis', or northern lights.

Space Weather

The term 'Space Weather' refers to conditions created on the earth by activity on the surface of the Sun. Solar activity follows an 11 year cycle. The peak period or *solar max* results in a greater number of solar flares or more violent coronal mass ejections (CME). Solar phenomena of interest to us include electromagnetic radiation and Solar Winds.

The sun's electromagnetic radiation spans infrared, visible, and ultraviolet wavelengths and the radio portions, x-rays and beyond. Electromagnetic radiation moves at the speed of light, and begins to affect the Earth's atmosphere around 8 minutes after it leaves the surface of the sun. Increased levels of electromagnetic radiation may 'black-out' the use of radio signals for HF radio communication.

In addition to electromagnetic radiation, the sun constantly ejects clouds of matter in the form of atomic and subatomic particles. The collective term for these gas clouds is the Solar Wind. The Solar Wind normally travels at approximately 400 km/second, so it takes 2-4 days to reach the earth. During periods of increased activity this speed increases, and the strength and direction of the earth's magnetic field is changed.

The polar auroras become larger and more vivid, the ability of the ionosphere to propagate HF radio signals is reduced, GPS navigation accuracy may be reduced and radiation levels may increase beyond recommended human dosage levels. Due to the shape of the earth's magnetic field, these changes are concentrated and most noticeable in the Polar Regions.

Space Weather Monitoring and Alerting

The National Oceanic and Atmospheric Administration's (NOAA) Space Environment Center (SEC) operates a worldwide network of sensors, which continuously observe conditions between the earth and the sun.

Updated every three-hours beginning at 0000 UTC, Geophysical Alert Broadcasts are concerned with both electromagnetic and solar radiation.

The NOAA website *http://www.sec.noaa.gov/SWN/index.html* provides real-time information on space weather. Forecast space weather is provided at *http://www.sec.noaa.gov/forecast.html*.

Cosmic Radiation Exposure

Galactic cosmic radiation (GCR) emanates from outside the solar system. Occasionally a disturbance in the sun's atmosphere leads to a surge in radiation particles. Protection is provided by three influences, the sun's magnetic field, the earth's magnetic field, and the earth's atmosphere. Exposure rates are dependent on altitude, latitude and the solar cycle. Exposure rates increase at higher altitudes and higher latitudes up to 55°N (geomagnetic knee).

Human radiation dose levels are measured in Millisieverts (mSv) which are used to place all of the radiation types on an 'equivalent' basis with respect to the biological effect. The maximum regulatory annual dosage established by the GCAA is 6mSv. Etihad Airways applies a limit of 5.

Etihad Dispatch continually monitors solar activity and adjusts flight routings to avoid cosmic radiation that exceeds certain limits.

Solar activities occur at fairly regular frequencies and are monitored by the National Oceanic and Atmospheric Administration (NOAA) if the United States. These activities, rated on scales designed by NOAA, which are of interest to commercial airlines, are:

Geomagnetic Radiation

Geomagnetic radiation generally affects the accuracy of the GPS navigation system and is rated as:

G1 – Minor. Minor impact on satellite operations possible.
G2 – Moderate Possible errors.
G3 – Strong Intermittent satellite navigation problems may occur. Position errors likely.
G4 – Severe Satellite navigation degraded for hours. Increased errors.
G5 – Extreme Satellite navigation may be degraded for days. Major position errors.

Solar Radiation

Solar radiation affects humans physiologically and is rated as:

S1 – Minor No effects. Small effect on high frequency (HF) radio in polar region.
S2 – Moderate No effects. Infrequent satellite event upsets, slight effect to polar cap HF.
S3 – Strong Passengers and crew in commercial jets at high latitudes may receive low level radiation exposure. Damage to exposed satellite components, degraded HF at polar cap.
S4 – Severe Elevated radiation exposure to passengers and crew in commercial jets at high latitude is possible. Satellite star tracker orientation problems, blackout of HF radio at polar cap for several days.
S5 – Extreme High radiation exposure to passengers and crew in commercial jets at high latitude is possible. Loss of some satellites, no high frequency (HF) communications in Polar Regions.

Electromagnetic radiation

Electromagnetic radiation generally affects the HF communications and is rates as:

R1 – Minor Weak or minor degradation of HF radio communication, occasional loss of radio contact.
R2 – Moderate Limited blackout of HF communication on sunlit side, loss of radio contact for 10 minutes
R3 – Strong Wide area blackout of HF radio communication, loss of radio contact for about an hour on the sunlit side of the Earth
R4 – Severe HF communication blackout on most of the sunlit side of the Earth for 1 to 2 hours.
R5 – Extreme Complete HF radio blackout on the entire sunlit side of the Earth lasting for a number of hours.

Polar Restrictions

Polar flights may be affected by increased activity on the surface of the sun. Items of particular interest are the reduction or complete loss of HF radio communications, the degradation of GPS accuracy and the exposure of passengers and crew to higher than normal levels of radiation. Flights over the polar area may have to be rerouted or even curtailed until conditions improve.

Radio Blackout Scale

- **No flights may operate on polar routes if Solar Radiation, Radio Blackout or Geomagnetic Storm activity is at level 4 or 5.**
- **Radio blackout level 2 (R2) or 3 (R3) will require a non-polar routing.**

Supplementary Information

BOEING Fuel temperature information

Due to the extended flight duration and the prevalence of very cold air masses on the Polar routes, the potential exists for fuel temperatures to approach the freezing point. However, current airplane systems and operating procedures provide confidence that fuel will continue to flow unobstructed to the engines in all plausible cold-weather conditions likely to be experienced on polar routes.

Fuel Freeze Point

The freezing point is the temperature at which wax crystals, which form in the fuel as it cools, completely disappear when the fuel is warmed.
As jet fuel is a mixture of many different hydrocarbon molecules, each with its own freezing point, jet fuel does not become solid at one temperature as water does. As fuel is cooled, the hydrocarbon components with the highest freezing points solidify first, forming wax crystals. Further cooling causes hydrocarbons with lower freezing points to solidify, and so on until the fuel freezes to a near block of hydrocarbon wax. As the freezing point is defined as the temperature at which the last wax crystal melts, therefore the freezing point of fuel is well above the temperature at which it completely solidifies.
However, the fuel freezing point is not what dictates fuel flow to the boost pumps. The critical condition of cold fuel in an airplane fuel tank, in terms of flight safety, is its propensity to flow toward and into the boost pump inlets. Pump ability, or flow ability, depends on the pour point of the fuel.
The pour point is defined as the lowest temperature at which the fuel still flows before setting into a semi-rigid state. Generally the pour point is approximately 6°C lower than the fuel freezing point.
Refueling airplanes at different stations creates a blend of fuels in the tanks, each with a unique freezing point. The resulting freezing point in each tank can vary widely. Boeing has published a procedure for estimating the freezing points of blends of Jet A and Jet A-1 fuel. But if the actual freeze point of the fuel used for the flight is not known or cannot be determined, then the following Fuel Specification Freeze points should be used:

- **JET A1…….. -47^{0}C (Fuel supplied in AUH)**
- JET A…… -40^{0}C (Fuel supplied in LAX)
- TS-1 or RT…… -50^{0}C (Fuel supplied in Russia)
-

Refer to Polar CBT Chapter (3) “Fuel Freeze points, A fuel analysis procedure is not required when Fuel Jet (A1) is uplifted, as it has a lower freezing point of -47 centigrade and is therefore not critical for trans polar flights. Therefore it is not required to conduct fuel freezing analysis either from AUH due to JET (A1) or from KLAX the sector will route Non Polar.

POLAR OPS – CREW OPERATING PROCEDURS

PRE-DEPARTURE

Dispatch

At the Briefing Centre, Crew will be provided with fuel temperature prediction charts in addition to the usual documents necessary for the flight. The Solar activity forecast will be analysed and reflected by a remark on the OFP."

A "Polar Plotting Chart" is provided with the briefing documents for the flights operating through the Polar Region. The chart must be returned with the flight envelope. A spare Polar Orientation Chart shall be collected at the Briefing Center and left in the envelope if not used.

The LIDO flight planning system will normally select the optimum route for the flight. If a Polar Route is selected, Flight Dispatch will check for any conditions e.g. radiation forecast, cold air, or availability of en-route alternates that may preclude its use. In such an event, a non-polar route will be used.

- No flights may operate on Polar Routes if the Solar Radiation, Electromagnetic Radiation or Geomagnetic Radiation activity is at level 4 or 5.
- If the Solar Radiation is at level 3, Polar flights will be planned to operate at FL 310 or below.

Due to the lack of ATC flexibility, planned routes should be flown as filed. The ATC system of Russia generally does not allow direct routing or a change of route.
A route shall be planned such that the aircraft will, when in the Polar Region, be within a maximum diversion time of:

- B777: 180 minutes, at a one-engine inoperative cruise speed of 420 Knots TAS, from any available en-route alternate.

Cold Fuel Management – Dispatch

During the winter months, areas with Outside Air Temperatures of -68^0 C are common in the Polar Region thus creating a potential for fuel temperatures to approach the fuel freeze point. Whenever possible, a Polar Route that avoids these cold areas will be selected. Dispatch shall not plan a route through areas of -65°C (ISA -8 at 36,000 ft and above) or colder for more than 90 minutes.

Boeing has developed the Fuel Temperature Prediction Program (FTPP) for the B777 which will be utilized by Etihad. The program assists in addressing the fuel freezing point concerns during the flight planning process. It helps determine if fuel temp will become a concern during the course of the flight, and helps determine available options.

AT THE AIRCRAFT

- Aircraft Technical Status – Check.

In addition to the requirement of at least two Long Range Navigation Systems (LRNS) e.g. required for MNPS operations, the following is also required for Polar operations:

1. A fully serviceable APU.
2. A Fuel Quantity Indication System (including the fuel temperature indication)

3. Auto-Throttle system
4. Communication system appropriate for the route to be flown
5. 1 arctic suit per each operating crew member
6. At least 1 automated external defibrillator (AED)

Additional SEP equipment must also be carried – listed separately.

Refer to MEL.

- Apply normal POS INIT procedures

NB: Limitation: ADIRU Alignment must not be attempted at Latitudes greater than 78 degrees, 14.75 minutes.

Cold Fuel Management – At Aircraft

As part of the preflight procedure and cockpit set up, the minimum fuel operating temperature needs to be inserted into the CDU PERF INIT page. This figure needs to be at least 3 degrees warmer than the fuel freeze temperature for the given fuel. For Jet A this will be -37°C and for Jet A-1 -43°C. This is due to the fact that there will be residual fuel left in the tanks prior to refueling which will have the net effect of increasing the actual fuel freeze point temperature. It is not anticipated that fuel freeze analysis will be required. This will be determined by Flight Dispatch.

IN-FLIGHT

Area of Magnetic Unreliability

- In the Polar Region (Area of Magnetic Unreliability), magnetic heading/track information is not reliable as a result of large magnetic variations, therefore navigation in this area is referenced to the True North.
- In Canada, the area of magnetic unreliability is defined as the entire Northern Domestic Airspace i.e. the Northern Control Area (NCA) and the Arctic Control Area (ACA).
- In Russia, the area of magnetic unreliability is not defined, but Airways in Russian airspace south of 74°N are referenced to magnetic north.

Navigation

- When tracks are referenced to TRUE, select TRUE by pressing the Heading Reference switch to TRUE.
- True north is automatically referenced anyway when north of 82°N or when within the vicinity of the magnetic poles. This is annunciated by a white box around the word TRU on the ND. The ND displays a green box around the word MAG to annunciate the change back to magnetic reference when leaving the Polar region.
- If the Heading reference is TRU in the descent phase, the ND displays a flashing amber box around the word TRU.
- The ND track and magenta lines may exhibit ratcheting when transiting routes in close vicinity to the pole.
- The current GRID heading displays near the top of both ND's when the airplane is north of 70°N. The GRID heading is not used by any airplane system.

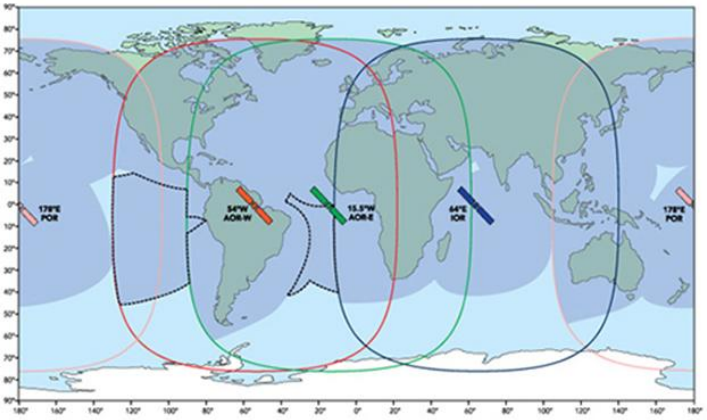
- If the North Pole (NPOLE) waypoint is used, a rapid heading and track reversal occurs passing the polar waypoint. If operating in HDG/TRK SEL or HDG/TRK HOLD while near the pole, it is necessary to update the heading/track selector frequently to reflect the rapid change or reversed heading/track, or the AFDS will command an unwanted turn. For this reason, LNAV is the preferred role mode.
- HDG SEL/HOLD and TRK SEL/HOLD are functional but require the manual selection of TRUE heading reference. Deviations from the planned route may be accomplished in TRK SEL or HDG SEL
- Use caution when using ADF or VOR equipment. The heading reference in use will affect the display of data. With heading reference in TRUE:
    - ADF bearings are TRUE and measured at the Airplane, not the ground station.
    - VOR radials are displayed according to the orientation of the VOR station and are TRUE.
- If the ADIRU fails in a Polar region, the EICAS message NAV ADIRU INERTIAL displays and all autopilot and AFDS roll modes fail. When heading information is restored by entry of a reference heading on the POS INIT page, HDG SEL and HDG HOLD roll modes are restored. GPS continues to provide navigation data to the FMC and active route information displays on the ND.

Communications – ATC

Communications using VHF or HF. The following communication facilities are available for Polar flights:

- Continuous communication coverage is normally available using VHF or HF while operating in the North Polar Region.
- SATCOM is available south of up to 82°N with CPDLC also available in certain ACC's. Also, within the FIRs of Anchorage and Edmonton further areas of SATCOM shadows exist.

Satellite AIRCOM coverage



- Arctic Radio, controlled from North Bay, provides VHF coverage throughout the Canadian Arctic between 63^0 N and 80^0 N

- An HF transmitter at Cambridge Bay, which is also controlled by Arctic Radio, allows long range communication with Edmonton ATC.
- ARINC also provides Polar Region long range HF using a transmitter at Barrow, Alaska.
- If HF radio communications with Gander are difficult, Polar flights may call Edmonton Centre on 001-780-890-8230 using SATCOM and speak directly to the Polar Controller.

- On the Russian side of the Arctic Ocean, either Magadan or Murmansk Oceanic Control Center (OACC) using HF and CPDLC provide communication with ATC.
- Crossing the Russian FIR boundary without radio communication is prohibited except for the cases when the radio communication failure occurred in flight with the aircraft being under direct control of an ATC unit of Russia or upon receiving the ATC Unit clearance to enter Russian airspace. In case of communications failure within Murmansk OCA pilots shall try to establish communication with Magadan OAC in order to make a position report.

For Murmansk OCA:

HF communications on designated frequencies: 11390 kHz (primary), 8950 kHz (secondary), 5694kHz, 4672kHz.

For Magadan OCA:

HF communications on designated frequencies: 11390 kHz (primary), 8837 kHz (secondary); CPDLC channel of Magadan OAC for FANS equipped aircraft.

- VHF is available within 200NM of the Russian 'coast', where 'domestic' communication is resumed. Expect to give estimates for entry points.
- In the event of communication failure while in compliance with IFR procedure, the aircraft shall proceed to the destination aerodrome in accordance with the flight plan
- Phone patch is available through Stockholm Radio.
- During periods of increased solar flare activity there may be a reduction or loss of HF capability. Flights will not be planned through areas of moderate or greater solar flare activity if this is known to flight dispatch at the time of planning, therefore HF communications should not be degraded.

Note: With the exception of Murmansk which has HF SELCAL, HF SELCAL is not available in Russian airspace. Crew has to maintain a listening watch.

Note: Use standard phraseology when communicating with Air Traffic Controllers in Russia

Company Communications

Communications between the aircraft and NOC shall be accomplished using the following systems priority:

1. SATCOM voice (Above 82N the function is not Serviceable)

2. ACARS – ACARS communications between aircraft and ground systems is achieved via the VHF, SATCOM and HF Datalink. The selection is automatic.
3. HF Phone patch – Using the appropriate HF frequency and depending on the location of the aircraft, establish contact with Stockholm, Berna or Portishead Radio and request a phone patch service.

Note: When operating at high latitudes, ACARS communications are transmitted using the HF Data link system. In order for it to function, crew should ensure that HF 2 is selected to the data mode.

Cold Fuel Management – In Flight

A minimum in-flight fuel temperature advisory message provides a margin of safety under all atmospheric and operational conditions to ensure that the fuel will continue to flow to the boost pump inlets.

This ensures that once this minimum fuel temperature is reached in flight, the EICAS FUEL TEMP LOW advisory is activated, which allows the crew to manage the situation actively according to the QRH procedure so as to avoid further fuel cooling to the freeze point value.

[ ] FUEL TEMP LOW

Condition: Fuel temperature is near the minimum.

1 Increase airspeed, change altitude or deviate to a warmer air mass to achieve a TAT equal to or higher than the fuel temperature limit (3 degrees C above the fuel freeze point).

2 TAT increases approximately 0.5 to 0.7 degrees C for each .01 Mach increase in airspeed. In extreme conditions it may be necessary to descend as low as 25,000 feet.

It takes approximately 15 minutes to 1 hour for a change in TAT to affect the fuel temperature. The rate of cooling of the fuel is approximately 3°C/h. A maximum of 12°C/h is possible under the most extreme cold conditions.

In consultation with Air Traffic control and NOC, the flight Crew decides on a plan of action which needs to ensure a TAT increase. This can be achieved by:

- Changing the route to where warmer air can be expected.
- Descend to a lower altitude. The required descent would be within 3,000 to 5,000 ft of optimum altitude. This may require descending even to 25,000 ft.
- Climb to a higher altitude. Recent experience on Polar routes has shown that the temperature may be higher at higher altitudes
- Increase the Mach number.

PLAN A STRATEGY BEFORE THE FUEL TEMP REACHES THE MINIMUM FUEL TEMP.

Space Weather Monitoring and In-flight Strategy

In addition to providing crew with a radiation forecast, Flight Dispatch regularly monitors space weather activity through NOAA's Space Environment Center based in Boulder, Colorado. Space weather activity forecasts are usually accurate for up to a week.
In the unlikely event of an unanticipated Solar radiation activity exceeding level S2 while en-route, Flight Dispatch will alert the crew. Since a re-route in the Polar region is not probable, descending to a lower cruising flight level is recommended.

Solar radiation at level 3 (S3) will require Polar flights to be conducted at FL310 or below. The effects of Solar Radiation are attenuated rapidly with decreasing altitude below 50.000 feet. Descending to FL 310 or lower increases the layer of atmosphere that acts as a shield above the aircraft thereby reducing as much as possible, the exposure to radiation.

Crew may also elect to increase cruising speed as an added measure to reduce exposure time.

En-route diversion

A diversion to any airport in the Polar region or Northern Russia should be considered only in the event of an extremely serious aircraft emergency, e.g. uncontrollable fire or an impending airframe failure. While these airports are adequate for landing, they are generally inadequate in terms of passenger handling, aircraft handling and maintenance. During the winter months, severe weather conditions with extremely low temperatures and strong winds can be expected at these airports. In addition, the medical facilities there may not be adequately equipped to manage life-threatening illnesses.

In the event of an in-flight medical emergency and there is no doctor or medical personnel on board, crew can seek medical advice from "Medlink". "Medlink" can be contacted by SATCOM or making a HF phone patch.

If a doctor or medical personnel on board recommends expeditious hospitalization for the patient, the Commander shall contact "Medlink" for further consultation and concurrence. The decision to divert to a remote airport for a medical emergency lies solely with the Commander who has to take into consideration the safety of the flight, suitability of the en-route alternate, the prevailing weather conditions and the nature of the medical emergency. A careful evaluation of the situation is necessary.

The rudimentary ground support and/or severe weather conditions at a remote alternate airport may result in the aircraft being stranded for many hours or even days.

Conditions permitting, an alternate airport listed in the table below as Category "En-route Alternate Airport" rather than "Emergency Airport" is preferred (refer to section "En-route Alternates" below). Crew should inform NOC stating the intention to divert, as soon as practicable.

If the diversion is to an airport in Russia, be prepared to apply the Metric Altimeter Operations (Ref. OM-C/Skybook).

For the purpose of Trans Polar Operations, the en-route alternate airports are categorized in 2 categories: En-route and Emergency

ICAO/IATA	Airport Name	Lat/Long	RFF	RWY	Longest RWY (m)	APCH	Use for:
BGSF/SFJ	Kangerlussuaq Sondre Stromfjord	N6701.0 W05041.4	CAT 5 * CAT 8 4HR PN	10/28	2810	MKR LOC	Emergency
BGTL/THU Airport with runway, VOR and ILS referenced to True North	Thule	N7631.9 W06842.2	CAT 7	08/26	3048	ILS	Emergency
BIKF/KEF	Keflavik	N6359.1 W02236.3	CAT 9	11/29	3065	CAT II	En-route Alternate
CYEG/YEG	Edmonton	N5318.6 W11334.8	CAT 8	02/20	3353	ILS	En-route Alternate
CYFB/YFB	Iqaluit Frobisher Bay	N6345.6 W06833.3	CAT 5 (OPS Hours)	17/35	2621	ILS	Emergency
CYMM/YMM	Fort McMurray	N5639.2 W11113.6	CAT 6	07/25	2286	ILS	Emergency
CYVR/ YVR	Vancouver	N4911.7 W12311.0	CAT 9	08R/ 26L	3506	CAT II	En-route Alternate
CYWG/ YWG	Winnipeg	N4954.6 W09714.4	CAT 7 (CAT 8 24HR PN)	18/ 36	3653	CAT II	En-route Alternate
CYXE/ YXE	Saskatoon	N5210.3 W10642.0	CAT 7	09/27	2530	ILS	Emergency
CYXY/ YXY	Whitehorse	N6042.6 W13504.0	CAT 7	14R/32L	2896	ILS	En-route Alternate
CYYQ/YYQ	Churchill	N5844.2 W09403.4	CAT 4	15/33	2804	ILS	Emergency
CYZF/YZF	Yellowknife	N6227.8 W11426.6	CAT 6	15/33	2286	ILS	Emergency
EFRO/RVN	Rovaniemi	N6633.7 E02549.9	CAT 7	03/21	3002	CAT II	En-route Alternate
ENBO/BOO	Bodo	N6716.2 E01421.9	CAT 6	07/25	2528	ILS	Emergency
ENSB/LYR	Svalbard Longyear	N7814.8 E01527.9	CAT 4 (CAT 7 PN)	10/28	2483	ILS	Emergency
ENTC/TOS	Tromso	N6940.9 E01855.1	CAT 7	01/19	2392	ILS	En-route Alternate
PAFA/FAI	Fairbanks Intl.	N6448.8 W14751.6	CAT 6/7	01L/19R	3597	CAT II	En-route Alternate
PANC/ ANC	Anchorage	N6110.4 W14959.9	CAT 9	07R/ 25L	3230	CAT III	En-route Alternate
ULLI/LED	St.Petersburg	N5948.0 E03015.9	CAT 8	10R/28L	3780	CAT II	En-route Alternate
ULMM/MMK	Murmansk	N6846.9 E03244.8	CAT 7	14/32	2500	ILS	En-route Alternate
UNNT/OVB	Novosibirsk	N5500.7 E08239.1	CAT 8	07/25	3600	CAT II	En-route Alternate
UOOO/NSK	Norilsk	N6918.6 E08720.0	CAT 8	01/19	3430	ILS	En-route Alternate
USCC/CEK	Chelyabinsk	N5518.3 E06130.3	CAT 8	09/27	3200	ILS	En-route Alternate

USRR/SGO	Surgut	N6120.6 E07324.2	CAT 7	07/25	2790	ILS	En-route Alternate
UUDD/DME	Moscow Domodedovo	N5524.5 E03754.5	CAT 8	14L/32R	3749	CAT II	En-route Alternate
UUEE/SVO	Moscow Sheretmetyevo	N5558.3 E03724.9	CAT 8	07R/25L	3700	CAT II	En-route Alternate
UWGG/GOJ	Nizhny Novgorod	N5613.8 E04347.0	CAT 7	18R/36L	2805	ILS	En-route Alternate

Recovery operations

A very important aspect of any diversion to an airport in a remote region is the safety and protection of the passengers and the recovery operation. The efficiency of the recovery operations will depend on a large part on the crew's ability to establish communications with NOC. Employ all available means to establish contact with NOC as soon as practicable after landing.

Global Avia, a company contracted to provide English-speaking personnel to assist the crew should a flight divert to any airport in Northern Russia, will be alerted as soon as NOC is informed of an intention to divert.

Depending on the location, it may require approximately 18 hours for a relief flight to reach the remote alternate. Several stations have been identified as points for the mounting of relief flights:

- Beijing and Seoul - For diversions to Northern Russia
- Any Northern European EY station - For diversions to North Scandinavia
- Any Northern US EY station - For diversions to North Canada

The Commander, with the assistance of the cabin crew and the contracted local agent, shall ensure that all the necessary has been accomplished to ensure the safety and comfort of the passengers and crew.

The Commander shall endeavor to remain in close communication with NOC, who will coordinate the recovery efforts.

Note: The SATCOM VOICE function requires the ADIRU to remain in the align mode.

Do not turn the ADIRU off.

If an extraordinary cold condition exists at the alternate and a lengthy stop is anticipated, crew shall ensure that the aircraft is safely secured.

Search and Rescue (SAR)

SAR efforts in the far north in extreme weather conditions have limited prospects for success. The key to improving the probability of a favorable outcome in search and rescue operations is the prompt notification by the crew to ATC.

- Alaska and Western Arctic

The U.S. Coast Guard Rescue Coordination Center (RCC) at Juneau, Alaska, coordinates SAR from Alaska to the Pole and South on the Russian side of the Pole as far West as 100^0 E to within 12 nm of the Russian coastline. The Coast Guard has an agreement with the Russian RCC in Vladivostok to assist the Russian SAR efforts with U.S. SAR resources from Nome and Anchorage. A Russian representative is attached to the Coast Guard in Juneau for liaison purposes and is on call 24 hours.

In an emergency, the Coast Guard will provide all available assistance. Several large Coast Guard and Air Force aircraft are available in the Anchorage area for SAR efforts.

- Canada

SAR service in Canada is available in Canadian airspace as far north as the North Pole

- Russia

Russia provides SAR service only within the radius of operations of search and rescue aircraft based at airports in the Russian Far North. This coverage does not extend to the North Pole. The U.S. Coast Guard can provide additional SAR resources in the event of an emergency situation in Northern Russia.