Aerodrome and Air Traffic Standards Division
Cold Temperature Corrections to Minimum Sector Altitudes (MSAs) and ATC Surveillance Minimum Altitude (ATCSMA) Chart Altitudes
Consultation Period 3 February 2012 – 27 April 2012

Comment Response Document

This document contains AATSD responses to all those comments received in respect of the consultation regarding cold temperature corrections to MSAs and ATCSMA Chart Altitudes.

Comments were received from:

BAe Systems (Operations)
BMIBaby
British Air Line Pilots' Association
British Airways, on behalf of the Flight Operations Group of the International Air Transport Association (IATA)
Eastern Airways
gCAP Ltd
Loganair
NATS
Thomas Cook Airlines
Thomson Airways
Tyrolean Airways

The CAA would like to thank contributors for their comments and for the care and attention that they afforded to this consultation.

No.	Comment	CAA Response
1	Within a European framework at the very least, airlines should expect a consistent approach from the ANSP. In the context of SESAR development/deployment a harmonised operational solution for FL/altitude clearances should be paramount (even if the background protocols are different). Thomas Cook Airlines therefore support an EASA based initiative rather than a local procedure. Any solution must be based on the premise that ATC is responsible for applying any correction, not the pilot. The potential for reduced airborne separation between well intentioned pilots in a high density environment is far greater than an actual CFIT event.	The CAA agrees that a consistent European approach is needed and that ATC should be responsible for applying any corrections to levels provided during radar or procedural operations. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol.

No.	Comment	CAA Response
2	We agree to Option e). Minimum Altitudes shall be corrected by ATS provider, otherwise aircraft with different cleared altitudes could operate without proper vertical separation due to different correction methods. Austria (and also some other EU countries) use a Min Usable FL table (and MRVA increment) in dependence to OAT which is continuously updated by METARs and made available to ATC. We found a very positive and practicable application for “creating low. temp. awareness” on the Airport of INN, where under low temperature conditions the Pilots get warned on the ATIS “for low temperature correction add (e.g.) 200ft to Min. Altitudes”; this awareness by ATIS should be a worldwide std. procedure whenever temp. is below ISA-10°. We have 2 references for cold temp correction in our internal documentation: - OM A specifies „low temp. correction when converting Min. Alt. into Min FL” (graph with key example), and - OM C specifies temperature correction in general.	The CAA agrees that ATC should be responsible for applying any corrections to levels provided during radar or procedural operations. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol. The CAA agrees that there is a need to enhance pilot awareness of the issue related to levels issued by ATC and how these levels relate to any corrections pilots make during the final approach phase as required by EU-OPS. The CAA thanks xxxxxx for details of their cold weather operations procedures.
3	Firstly, xxxxxx have a comprehensive policy for operating in temperatures below ISA. Some of the policy is copied below, although we have other references throughout our operations manuals. Of note is the third bullet point (highlighted) that we do not require pilots to adjust ATC assigned altitudes or levels when flying under radar control. We would expect any cold weather corrections to the cleared level or altitude to be made by the ATC unit. From an airline point of view, we recommend either option c) from your consultation (**Apply a progressively increasing correction as the temperature reduces in one degree steps**), however, we recommend for simplicity producing an increasing correction as the temperature reduces in ten degree steps below 0. The controller would therefore have a normal radar minimum altitude (accurate to 0 degrees) a cold weather minimum altitude e.g. +200ft (accurate to minus 10) and a very cold weather minimum altitude e.g. +400ft (accurate to minus 20). If this is not acceptable, we recommend option e ii) **(Introduce a local temperature correction that will apply appropriate corrections to MSAs and SMACs with increasingly cold temperatures and higher SMAC/MSAs).** Ultimately we agree that it would be better for the local ATC unit (with an understanding of the local terrain) to produce a cold weather correction procedure, but we feel that this must be following guidance from the CAA. Essentially, we would like a situation where controllers clear a pilot to an altitude or level that has sufficient terrain clearance in the atmospheric conditions at the	The CAA agrees that ATC should be responsible for applying any corrections to levels provided during radar or procedural operations. Any corrections made by ATC should be simple to apply and possibly related to temperature blocks. The CAA agrees that there is a need to enhance pilot awareness of the issue related to levels issued by ATC and how these levels relate to any corrections pilots make during the final approach phase. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol. The CAA thanks xxxxxx for details of their cold weather operations procedures.

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	(No. 3 Cont.) time. **Cold Weather Altitude Corrections** **Condition:** Cold weather temperature altimeter corrections are required. • No corrections are needed for reported temperatures above 0°C or if the airport temperature is at or above the minimum published temperature for the procedure being flown. • Do not correct altimeter barometric reference settings. • ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control. • Corrections apply to QNH and QFE operations. • Apply corrections to all published minimum departure, en route and approach altitudes, including missed approach altitudes, according to the table below. Advise ATC of the corrections. • MDA/DA settings should be set at the corrected minimum altitudes for the approach. **Minimum Flight Altitude Corrections** MFAs must be corrected according to the following: A. Cold Temperature Correction **Table 8.1** **Surface Correction to MFA** ISA - 16°C to ISA -30°C + 10% ISA - 31°C to ISA -50°C + 20% ISA - 51°C and below + 25%	

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4	I don't think that either of your suggestions for the solution is either wholly adequate or workable. What about airfields where there is limited or no ATC, for example, or when flying outside controlled airspace at low level IMC (which is where helicopters spend most of their time)? At airfields where there is ATC and the ability to instruct pilots to fly at a particular level (controlled airspace, basically) then ATC should add the temperature correction if one is appropriate and if a pilot is worried about whether it's been applied or not he/she can always ask. Outside controlled airspace, however, there is no need for a pilot to fly at the altitude suggested by ATC so another means of controlling the minimum altitude is required. Better, I think, to publish the lowest temperature at which each procedure is safe and to make sure that pilots are made more aware of the necessity to add a temperature correction **to all phases of flight**. This is something that I push when doing IR and TRI/TRE training and it's so badly understood; the fact that it's buried in the AIP and hardly anyone (in the helicopter world, at least) thinks that they have to bother with it is highly worrying. People seem to think that it applies to DA/MDA and forget that it applies during the cruise as well. The work involved in adding the minimum temperature to each plate would be significant but need not be done immediately and could be managed during routine procedure re-evaluation or amendment. This is not a new problem so there is no urgency to it, although an information notice could/should be put out in the meantime to remind pilots that they must add a correction when the temperature goes below a certain level. The important thing when educating pilots and ATC is to ensure that pilots realise that they must not simply add 'so many feet' to their altitude without telling ATC. For example, I've met pilots who believe that if they're cleared at 3000ft and the temperature correction is 400ft then they should fly at 3400ft but still continue to report their altitude as 3000ft. This is highly dangerous and needs to be stamped out. I tell pilots that in such a situation they should ask ATC for a level which is at least 400ft higher than the altitude which they know to be safe under normal circumstances; I believe that this is the only sensible solution.	The CAA acknowledges that the consultation is focused on where ATC is provided. Whatever the outcome of the consultation we will need to take into account aerodromes where no ATC exists. This re-affirms that there is still a need to provide additional education/ awareness of the cold temperature issue to pilots and where their responsibility lies. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol.

No.	Comment	CAA Response
5	My concern is with airfields such as xxxxxx, which is situated in areas of the highest ground in the UK and also suffers from the lowest temperatures. At 5000ft Minimum Radar vectoring altitude with a surface temperature of -15^{o}C, the temperature correction is around 600ft (PANS-OPS Vol 1 Pt VI Chapter 3 Table VI-3-1 b), if we add allowable altimeter tolerances for a non –servo 50 000 ft pressure altimeter of 125 ft (PANS-OPS Vol 1 Pt VI Chapter 2 Table VI-2-2) and then add the Pressure Error Correction from a typical AFM of 50 ft we have total system error of 775ft. Add to this the allowable Flight Technical Error for an aircraft without an autopilot of +/- 200 ft, you have in the worst case (All the “holes in the cheese” lining up): a) Temperature error – 600ft b) Permitted Pressure Altimeter calibration error – 125ft c) Pressure Error Correction – 50 ft d) Flight Technical error – 200ft Total error – 975 ft The probability of this occurring I am unable to say, but would like to draw your attention to the fact that this condition may exist in the Winters experienced within the Scottish FIR. At the very least the CAA should make it clear in the UK AIP that Minimum Radar Vectoring Altitudes procedures are based on ISA as per ICAO Annex 15. The xxxxxx preferred option would be to take the “French approach” as per 4.5 d) and disagrees with the statement “*For the limited times the cold temperature hazard occurs this is not considered to be a practical option”* as the cold temperature hazard has been is a reasonably frequent occurrence in the Scottish FIR in the past few years.	The CAA thanks the company for details of their cold weather operations procedures and the details of possible cumulative errors that can occur. The potential for errors is greatest at aerodromes near sea level but with high Minimum Sector Altitudes as the column of air is at its deepest. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol.
6	We have studied the Consultation Document ‘Cold Temperature Corrections to Minimum Sector Altitudes (MSAs) and ATC Surveillance Minimum Altitude (ATCSMA) Chart Altitudes’ and wish to proffer the following. Our view is that the lack of standardisation amongst Operators could compromise safety, and therefore policy should be introduced. On review of the Policy Options we feel that (e) (ii) ‘Balance of prescription versus risk-based approach’ would be the best option to examine further.	We agree that lack of standardisation could compromise safety and that a pan European approach is required. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol.

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7	There is a further Option: Detail pilots to calculate any revisions in accordance with aircraft operators manuals. Why? 1. The table reproduced in the consultation document, the UK AIP and the Military Flight Information Handbook is from the ICAO 8168 where it states that aircraft operators shall apply temperature corrections. 2. There is no common European ATC approach. 3. Pilots already calculate their own approach minima based on aircraft type, pilot competence and the aircraft's equipment, so a further correction would be easy to add. 4. Military pilots are already detailed to make their own adjustments. (Flight Information Handbook pg 52, and table pg 66). 5. Modern aircraft are fitted with significantly more accurate instruments than when these rules were designed. Equipment manufacturers could stipulate the accurate corrections required in consideration of atmospheric pressure and outside temperature in equipment manuals. ATC procedures cater for all aircraft and pilot capabilities and already allow for the following inaccuracies: 1. Aircraft are deemed to be in level flight even when their mode C readout indicates +/- 200 feet from the assigned level. 2. Obstacle heights within the SMAC are calculated in meters and then converted to feet. 3. A "whole" hPa covers a measurement of 27 feet. As aircraft equipment becomes more accurate, let the pilot and manufacturers develop their own corrections. For the rest of the flying population any adjustments need to be in whole hundreds of feet measurements as it is impossible to fly accurately in tens of feet measurements e.g.it would be impossible for an aircraft to fly at altitude 2470 feet. Making such adjustments will be introducing yet another height inaccuracy into constrained airspace.	There is already an existing EU-Ops requirement for operators to have procedures for pilots to make cold temperature corrections during final approach. These aircraft would very rarely be in conflict with another aircraft and result in a loss of separation. However, and in accordance with ICAO, we believe that responsibility for the corrections to Minimum Sector Altitudes or other levels used under radar control or procedural operations should rest with ATC. There needs to be a system that allows no doubt as to who has responsibility for any cold temperature corrections – the pilot or ATC. The system will also need to avoid excessive complexity or induce disproportionate risk.

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8	**Discussion** In the opinion of xxxxxx and xxxxxx the consultation document contains some flaws of analysis and, consequently, the conclusions inferred are also flawed. It appears the CAA has concluded that there could be a 'serious reduction of terrain clearance' without any analysis of the event in question at Manchester. For example, CAA personnel were requested to obtain the atmospheric-thickness data for the day in question from the Met Office to determine the actual altitude deviation of the aircraft. That has not been done. Instead, standard temperature lapse-rate has been assumed to infer the aircraft was 380 ft lower than indicated. That would not have been the case, and it is likely that there was a significant temperature inversion on the day in question, such that the magnitude of the deviation was almost certainly much less than reported. Furthermore, there has been no analysis of the actual risk – presumed to be CFIT. Even had the aircraft been 380 ft lower than indicated, that would not have led to any increase in risk of a CFIT accident. The CAA quoted ICAO Doc 8168 (PANS-OPS) as stating that aircraft operators shall apply temperature corrections '...to all minimum altitudes...'; and Doc 4444 (PANS-ATM) as stating 'when necessary, the relevant minimum vectoring altitude shall include a correction for low temperature effect' and 'it is the responsibility of the ATS authority to provide the controller with minimum altitudes corrected for temperature effect.' But, of course, there have been nearly 100 years of operation in the UK with no evidence of any incident hitherto caused by the non-application of some or all temperature correction. In fact, operators use much higher margins in their MSA calculations, which start at 1000ft and increase rapidly, one reason why there is a blank accident record. We take issue, therefore, with the following statement from the Consultation Document, specifically the emboldened highlights: > Following discussions internally within the CAA, there is consensus that the current situation needs action as **we now have an identified hazard** with **the possibility of a significant reduction in terrain clearance**. There is also an expectation from elements of industry that a new procedure will be required as the subject has been discussed widely at the NATS SPA with aircraft operators. Lastly, referring to the table at the top of page 2 of the Consultation Document, we note that the lowest temperature ever recorded in the UK (on three occasions since 1895) is -27.2 degrees C. That fact alone would suggest the need to apply any correction is negligible.	The Met Authority did review the event in question, a temperature of -14 Deg C occurred at 0550 on 20 December 2011 at Manchester Airport. As there is no radiosonde data available for Manchester Airport, the nearest location was Nottingham where a sonde was launched at 00Z. It was noted that the radiosonde showed a 4,000 ft temperature of -30 Deg C. The thickness is the average temperature over the layer which at Nottingham, using the top of inversion temperature at 300 ft, was -2 Deg C making a thickness of -14 Deg C (258 K). If the surface temperature was -14 then the thickness would be -22 Deg C (251 K). The mean ICAO ISA temperature for surface to 4,000 ft is 11 Deg C (284 K). The calculation of the difference in height indicated by an altimeter (which uses an ISA temperature correction) is: $h = (T / T_m)h' = (1 + (T - T_m)/T_m))h'$ Where h' is the indicated height on the altimeter, T is the mean temperature (kelvin) of the air column from the pressure at zero height to the height of the altimeter and T_m is the mean standard temperature (kelvin) within this range of pressure. For practical circumstances, the expression $T - T_m$ can be replaced (as an estimate) by the difference between the observed and standard temperatures at the indicated height. Therefore, if the aircraft was at an indicated height of 4,000 ft, using the above formula, with a top of inversion temperature of -2 Deg C, suggests that the actual height would have been 3,619 ft (difference of 381 ft). Using the lower surface temperature value of -14 Deg C, the aircraft would have been at 3,535 ft (difference of 465 ft). The above analysis does show that there is a risk of reduced terrain separation during cold weather and that the presence of an inversion may or may not affect the actual level above the ground or an obstacle. If a new procedure is required as a result of this consultation the CAA will by default have to use a standard lapse rate for temperature. From the analysis of the actual incident a degree of risk does exist. The CAA, with industry, now needs to establish whether the very infrequent likelihood of events requires action in the form of a new procedure, which in itself might generate complexity and consequent risk. It should be noted that some other CAAs and ANSPs around the world have identified this issue as a risk and implemented procedures to mitigate that risk.

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	(No. 8 Cont.) **Conclusions** The CAA consultation seems to be motivated more by the thought that 'something has to be done' than by any proper consideration of risk: • The analysis of the event in question is inadequate • Thus, the measure of any associated risk is also inadequate • There has not been a CFIT accident in the UK caused by low temperature • There is no apparent risk of one happening if the status quo is maintained.	
9	**What is the risk** Although more detailed analysis of the incident that prompted this consultation has not been made widely available, xxxxxx understands that as a result of not correcting an altimeter during very cold temperatures, there is a degree of risk associated with aircraft being closer to terrain or obstacles than indicated to aircrew and ATS providers, when operating at MSA/SMA. The problem for Industry and the Regulator is that the ICAO mitigation for the assumed risk is largely based on a standard temperature lapse rate, which realistically cannot be guaranteed to exist at all times and within all met conditions; in reality the degree of risk is largely uncertain. xxxxxx has attempted to quantify the level of risk and has carried out analysis of aircraft movements around Glasgow and Aberdeen in the winter of 2010/11; these airfields were chosen because either they have high SMAs and/or they experience lower than average UK surface temperatures. The analysis sampled the coldest days and captured flight data on aircraft operating around the various SMAs. Unfortunately in the short time available for the consultation, we were not able to capture other relevant information such as flight rules and type of ATS and so we were unable to ascertain whether flights appearing to operate below the SMA were there because the aircraft's altimeter was over reading or they were legitimately there for a different reason. Also the analysis was based on the reported Mode C altitude, and not the actual aircraft altitude, therefore not enabling us to ascertain the altimeter error caused by cold weather.	From the analysis of the actual incident shown above a degree of risk does exist. The CAA, with industry, now needs to establish whether, due to the very infrequent likelihood of events, action in the form of a new procedure, which in itself might generate complexity and consequent risk, is required. It should be noted that some other CAAs and ANSPs around the world have identified this issue as a risk and implemented procedures to mitigate that risk. The Met Authority did review the event in question, a temperature of -14 Deg C occurred at 0550 on 20 December 2011 at Manchester Airport. As there is no radiosonde data available for Manchester Airport the nearest location was Nottingham where a sonde was launched at 00Z. It was noted that the radiosonde showed a 4,000 ft temperature of -30 Deg C. The thickness is the average temperature over the layer which at Nottingham, using the top of inversion temperature at 300 ft, was -2 Deg C making a thickness of -14 Deg C (258 K). If the surface temperature was -14 then the thickness would be -22 Deg C (251 K). The mean ICAO ISA temperature for surface to 4,000 ft is 11 Deg C (284 K). The calculation of the difference in height indicated by an altimeter (which uses an ISA temperature correction) is: $h = (T / T_m)h' = (1 + (T - T_m)/T_m))h'$ Where h' is the indicated height on the altimeter, T is the mean temperature (kelvin) of the air column from the pressure at zero height to the height of the altimeter and T_m is the mean standard temperature (kelvin) within this range of pressure. For practical circumstances, the expression $T - T_m$ can be replaced (as an estimate) by the difference between the observed and standard temperatures at the indicated height.

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	(No. 9 Cont.) As well as the actual terrain risk there is an additional risk of confusion between aircrew and ATC as to who is applying a temperature correction at a particular point in time. ICAO PANS-OPS is clear on a pilot's responsibilities for temperature correction to maintain obstacle (xxxxxx is happy to provide the analysis to the CAA if requested.) clearance, for example from published altitudes within Instrument Approach Procedures (IAP). ICAO PANS-ATM also states that for aircraft under radar control when being radar vectored, ATC is responsible for temperature correcting allocated levels. However currently there is no UK Regulatory requirement for ATS providers to do this. NATS understands that some UK operator SOPs confirm the ATC responsibility and so there is a risk that when being radar vectored, aircrew are expecting allocated levels to be terrain safe when this may not be the case. **Evidence of the risk** The xxxxxx STAR reporting system has only one recorded incident related to cold weather events in the last six years. In that incident the pilot levelled off above ATC cleared levels because he was temperature correcting. ATC was not aware of the requirement for this and the ensuing conversation was an unnecessary distraction. There is other anecdotal evidence of RTF exchanges where aircrew have assumed ATC has corrected an allocated level but the controller has been unaware of the requirement. Further there is very little evidence from surveillance monitoring that pilots are correcting for temperature during pilot interpreted IAPs. **Application** Until such time as studies to quantify the real level of risk during cold temperature scenarios are carried out, possibly by measuring the real altitude of aircraft using multi-static surveillance technology or by using other Met Office techniques, the Global regulatory requirement leads xxxxxx to assume that a level of risk does exist and that a level of temperature correction ought to be applied in certain circumstances. Using the PANS-OPS temperature correction table (Doc 8168 PANS-OPS Vol I, Part III, Table III-1-4-1 b)) as the basis for determination of the temperature correction required, xxxxxx would be content if the following principles were accepted as being the basis for a UK wide procedure, appropriate enough to mitigate the perceived risk.	(Cont.) Therefore if the aircraft was at an indicated height of 4,000 ft, using the above formula with a top of inversion temperature of -2 Deg C suggests that the actual height would have been 3,619 ft (difference of 381 ft). Using the lower surface temperature value of -14 Deg C, the aircraft would have been at 3,535 ft (difference of 465 ft). The above analysis does show that there is a risk of reduced terrain separation during cold weather and that the presence of an inversion may or may not affect the actual level above the ground or an obstacle. If a new procedure is required as a result of this consultation the CAA will by default have to use a standard lapse rate for temperature. Further analysis of events captured during cold weather events would prove useful and could form part of a wider debate that may be required to develop a European position. Following the consultation further information became available regarding frequency of cold temperature events: There are no recorded occurrences of -10 Deg C or lower at Heathrow in the last 10 years. Manchester (Woodford) shows the following over 10 years: | | No of obs < -15°C | No of obs < -10°C | All obs | % of obs < -15°C | % of obs < -10°C | | --- | --- | --- | --- | --- | --- | | Jan | 9 | 32 | 5936 | 0.2 | 0.5 | | Dec | 0 | 54 | 6675 | 0.0 | 0.8 | Inverness data was not available, however two other sites were provided instead both for 10 year periods: Aviemore shows the following and could be considered one of the coldest locations in the UK: | | No of obs < -15°C | No of obs < -10°C | All obs | % of obs < -15°C | % of obs < -10°C | | --- | --- | --- | --- | --- | --- | | Jan | 17 | 71 | 7423 | 0.2 | 1.0 | | Feb | 17 | 79 | 6661 | 0.3 | 1.2 | | Mar | 0 | 18 | 7430 | 0.0 | 0.2 | | Nov | 0 | 14 | 7171 | 0.0 | 0.2 | | Dec | 26 | 189 | 7332 | 0.4 | 2.6 |

No.	Comment	CAA Response
	(No. 9 Cont.) • In accordance with ICAO requirements, for flights receiving an ATC service and receiving radar vectors, NATS controllers could apply an altimeter correction of 400ft to aerodrome SMAs of 3,000ft or above (as depicted in SMACs within the UK AIP), when the aerodrome temperature is between -15°C and -29°C. ATC levels allocated above the SMA would not be temperature corrected. • For temperatures of -30°C and lower, a temperature correction of 1,000ft to all SMAs could be applied. The rationale for determining 400ft as the generic correction value is that when considering the standard vertical separation between two aircraft, the level occupancy rules allow each aircraft to be ± 200ft from their cleared level and still be considered as occupying that level. Therefore for a vertical separation of 1,000ft, a reduction of 400ft between the aircraft is considered acceptably safe. We have used the same premise to propose that an aircraft may be 600ft or more from terrain or an obstacle and still be considered safe. Therefore from the ICAO table, for any SMA below 3,000ft, there would be no need for a correction until the temperature reached about -30°C, as above that temperature not applying the correction would bring an aircraft no closer than 600ft from the obstacle/terrain. A correction of 400ft or more would need to be applied when the surface temperature was lower than -30°C but as the lowest recorded temperature within the UK is -27.7°C, we have concluded that this is an extremely unlikely event and therefore an aerodrome would not need to correct any SMA lower than 3,000ft. For SMAs of 3,000ft or above there needs to be a recognition that calculating correction values for each SMA and for each temperature variation, in order to mitigate a perceived risk, needs to be balanced against the need to ensure that ATM procedures are not cumbersome to apply in practice; not applying this principle can in itself create new hazards. The same issue would arise if the UK adopted the PANS-OPS table in full as a means to mitigate the perceived risk. Therefore although applying a 400ft correction may not appear sufficient for terrain/obstacle clearance for SMAs above 3,000ft and temperatures below -15°C, any shortfall between the 400ft applied and the theoretical correction would only result in a small reduction in the required clearance distance. To illustrate this, Glasgow has the highest SMA in the UK of 5,500ft and during the analysis sample period there were only twelve days when the temperature was -10°C or lower and the lowest recorded was -15°C. Applying a 400ft correction to a 5,500ft/-15°C combination would result in a 200ft shortfall from the theoretical	(Cont.) Whereas Kinloss shows (which is probably more representative of Inverness): No of obs < -15°C / No of obs < -10°C / All obs / % of obs < -15°C / % of obs < -10°C Jan 0 7 7440 0.0 0.1 Feb 0 2 6765 0.0 0.0 Nov 0 4 7197 0.0 0.1 Dec 0 30 7440 0.0 0.4 As you will note the frequency of when these conditions occur are low. Also the time of occurrence of these temperatures is likely to be early morning.

No.	Comment	CAA Response
	(No. 9 Cont.) requirement for a 600ft correction. Therefore an aircraft flying at this SMA might in reality be about 800ft from terrain/obstacles but xxxxxx would argue that this would still provide an adequate degree of clearance in the circumstances without the need for any further correction. During the sample period no incidents were reported or unusual activity observed and taken together with the historical lack of incident reporting around this issue, on balance xxxxxx feels that correcting SMAs at an above 3,000ft by 400ft when the temperature is between -15°C and -29°C, is qualitatively acceptable mitigation and results in any residual risk being considered tolerable. In extreme temperatures below -30°C, applying a correction of 1,000ft across the board appears overly restrictive but again to ensure the application of simple ATM procedures, this correction covers nearly all combinations of SMA and temperature and would only have to be applied in extremely rare cases. **Potential Impacts** The application of a temperature corrected SMA should not normally impact the flight deck operation. Where a higher than normal minimum altitude is allocated, this may affect existing CDA profiles which may then result in slightly reduced environmental gains, slightly increased ATC workload and a general service delivery hit. Mitigation might be to suspend any CDA procedures during SMA temperature corrected days. There is the possibility of the perception by aircrew of their altimeter suggesting a higher than normal approach when in reality the aircraft might be physically at the correct procedure height. This will be dependant on the actual air temperature at the altimeter source and the reverse may be true if the temperature does not reduce at the standard lapse rate or there is an inversion aloft. In these instances allocation of a higher SMA level will result in the aircraft physically being higher than desired. **Further issues to be addressed** xxxxxx requests that the CAA also consider the following: • The CAA to survey UK operators to understand their SOPs with regard to temperature correction. • The CAA to survey UK operators and/or avionics manufacturers to ascertain whether any altimeters are self correcting for temperature. This could negate the requirement for any ATC SMA correction.	

No.	Comment	CAA Response
	(No. 9 Cont.) • Any future CAA policy on altimeter temperature correction also considers the affect of cold temperature on: levels within SRAs, IFR operations at or just above the base of CTA/TMA airspace where the base is defined as an altitude and safe overflight of segregated airspace e.g. Danger Areas, Prohibited Areas etc. **Conclusion** xxxxxx is content to apply a degree of mitigation against a perceived risk providing it balances the efficiency of the consequent ATM procedures against the risk probability and tolerability. xxxxxx would not support the requirement to use the PANS-OPS temperature correction table in all instances. Irrespective of the lack of evidence as to the level of actual terrain/obstacle risk it is imperative that as a minimum the CAA removes the confusion that exists between aircrew and ATS providers and issues clear policy/guidance as to whether there is a requirement for altimeter temperature correction and if so when is to be applied and by whom.	
10	Option a) Agree that this is unacceptable. Option b) Agree that this would be unnecessarily restrictive. Option c) It is not clear why the temperature interval of 1 degree was the only one considered. Because the altitudes to be corrected are always in hundreds of feet and the altitudes to be corrected in the UK are seldom as high as 5000' an interval of 5 degrees could be used, and for some airfields an interval of 10 degrees might be acceptable. This would greatly reduce the task for the ATCO. It is also believed that the regulatory task would be simpler than option e). This option should be reconsidered with the use of a larger temperature interval. Option d) Agree that this is not practicable. Option e) i) Because of the lack of a common approach this option would have a lack of transparency and provide scope for disagreement as to the resulting corrections. xxxxxx does not support this option. Option e) ii) This option largely removes the objections to option e) i) and is acceptable subject to the acceptable error being reasonably small.	The CAA thanks xxxxxx for its comments. Should a new process be identified it needs to be simple and related to the local aerodrome geography. However a common general approach is needed and we believe that there should be a common approach across Europe. A simple approach is preferred possibly using blocks of temperature within which an adjustment is made. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol.

No.	Comment	CAA Response
11	Having read through the five different Policy options, I would agree with the recommendation to adopt a procedure as in the fifth option (option e)). I would agree that the risk varies at different airfields due to their local terrain and obstacles. Therefore it makes sense that local corrections be applied. It is also important for the ANSP as well as the local ATC units be educated as to the meaning and significance of the need for low temperature correction. There should be a single common table similar to the one produced by Boeing and shown in their FCOM 1's. Commonality must be the key element to this so that all aircraft in the vicinity of an airfield are all applying identical corrections and commence applying these corrections at the same temperature. However the table to be used in the future to cover a wider spread of altitudes (up to 5000 feet [above airfield elevation]). This is therefore similar to the ICAO table. Any risk analysis should take into account the amount of likely error for various temperatures such that if the error is small at an airfield due to low elevation and low terrain or obstacles then the temperature at which corrections should start to be applied could be lower; for example -30º C. This information could be published in the AIP and on the flight crew aeronautical approach/airfield charts. It could then be up to the ATC unit to decide whether to use the lowest available altitude (MSA) for vectoring or to apply a correction and to use as the lowest altitude, a figure greater than MSA by an appropriate amount, e.g. 500 feet. For any procedural approach the pilot would correct all intermediate approach altitudes (and any holding altitudes, as applicable) when temperature is below the figure set by the airfield, and advising ATC accordingly. There would, additionally, be no change for operators to apply the corrections to their Decision Altitudes for all conditions below 0º C, which is currently what our company do as an SOP. The corrections referred to above are those for correction to altitudes such as platform altitude (intermediate approach) governed by SSA/MSA. I would therefore favour option e) ii) out of the five choices as most closely adhering to the above suggestions.	The CAA agrees that the 'risk' is very much related to local aerodrome geography. However a common general approach is needed and we believe that there should be a common approach across Europe. A simple approach is preferred possibly using blocks of temperature within which an adjustment is made. Further consideration needs to be given as to which would be the best way forward with ICAO, EASA and Eurocontrol.