

EASA	COMMENT RESPONSE DOCUMENT
	EASA PAD No. 15-099 [Published on 24 July 2015 and officially closed for comments on 21 August 2015]

Commenter 1: Meridiana fly – Sergio Carta – 27/07/2015
Comment # 1

Following the release of EASA PAD 15-099, we would like to provide the following comments for Meridiana fly Md80 fleet.

- [A]** PAD 15-099 Chapter 1.1: proposed Appendix 1 “NORMAL PROCEDURE” is focused on EPR erratic indication caused by undetected icing-condition. Similar events may also be caused by Pt2 probe clogging due to sand contamination, volcanic ash and insects’s nests accumulating on ground during aircraft parking under specific condition, such as heavy wind or proximity of plants to the airport airside. This should be taken into account in the proposed Appendix 1 “NORMAL PROCEDURE”.
- [B]** PAD 15-099 Chapter 1.2: proposed Appendix 2 calls for “UNRELIABLE EPR INDICATIONS”. Please be aware that Md80 QRH already cover “EPR ERRATIC OR FIXED” (see attachment) with both icing and non-icing conditions. According to PAD 15-099 this procedure shall remain valid with the additional Appendix 2 procedure that shall cover on icing-condition. This shall cause confusion.
- [C]** Also Appendix 2 calls for Airspeed - monitor: MD80 QRH already includes the emergency procedure “airspeed unreliable” which must remain valid and not against Appendix 2 requirements.
- [D]** Following some EPR erratic indication due to sand contamination and insects’s nests occurred in the past, Meridiana fly introduced some preventive actions such as engine inlet cover installation (for ground time longer than 2 days), the inspection of Pt2 probe at every night check and blow up of the Pt2 probe at every heavy maintenance check.

EASA response:

- [A]** *Comment not agreed. EASA technically understand that PT2 probe clogging due to the reasons described above may lead to similar false EPR indication as observed during the icing events intended to be addressed in the subject PAD. Nevertheless, EASA is not aware of any reports from operators highlighting a safety concern related to PT2 probe clogging due to the mentioned reasons neither through EASA Internal Occurrence Reporting System IORS nor through discussion with the TC Holder. Therefore, EASA has no reason to amend the subject PAD accordingly but kindly invite Meridiana to report any such occurrences to the TC Holder and EASA IORS.*
- [B]** *EASA confirm that the existing MD80 QRH procedure on “EPR ERRATIC OR FIXED” shall remain valid following the release of the final AD. In order to avoid any confusion and to clearly indicate the correct sequence of procedures to be applied EASA has amended Appendix 2 of the Final AD with the following Note referring to the MD-80 QRH: “Note: Following re-establishment of stabilized cruise flight the “EPR ERRATIC OR FIXED” procedure of the MD-80 QRH (page Eng.10.5 of MD-80 QRH dated 15 October 2012) might be applied”.*
- [C]** *Comment not agreed. The instructions defined in Appendix 2 of the AD are not in contradiction to the “AIRSPEED UNRELIABLE” emergency*

procedure of the MD-80 QRH.

[D] See EASA response to point [A] above. Meridiana is kindly invited to report any such occurrences and any efficient preventive actions taken to the TC Holder. In addition, the EASA AD is addressing a different safety issue.

No changes have been made to the Final AD in response to points [A], [C] and [D] of this comment.

Commenter 2: Access Aviation – Chris Roberts – 17/08/2015

Comment # 2

- A. In the section 'Reason' after an explanation that the auto-throttle system reduced N1 engine speed to keep the erroneous EPR within the limits it states that "... causing a gradual but rapid loss of airspeed." This does not make sense because either the airspeed loss was gradual, or it was rapid. It cannot be both (at the same time).
- B. Some MD-80 Manuals do not contain sufficient data for the crew to be able to ascertain the correct N1 for given EPR indications.
- C. A warning that nose cone pressure sensor icing can occur with no visible moisture apparent to the crew suggests that crews should be advised to operate with the engine anti-icing system switched on unless it can be positively established that there is no possibility of encountering icing conditions, by flight through, adjacent to or below atmospheric conditions that might give rise to crystalline ice. This is particularly relevant when operating through the ITCZ at night as has been borne out by the loss of two aircraft in a 5 year period where extreme or untypical icing conditions resulted in frozen sensors.

It is regrettable that in both of the cases I refer to in paragraph 3 above the fully qualified and well trained crews failed to manage a loss of control situation resulting in the destruction of fully flyable aircraft.

EASA response:

- A. *Comment agreed. The wording of the Final AD has been changed to read: "... causing a gradual loss of airspeed."*
- B. *EASA is aware that MD-80 manuals do not systematically include sufficient data to allow for checking of correlation of N1 vs EPR. The (S)TC Holder is expected to provide such data to any operator upon request.*
- C. *Even though EASA agree that the nose cone pressure sensor icing during the subject accident might have been caused by Ice Cristal Icing (ICI), EASA has no proof for this assumption. Therefore, and pending the release of the final accident report and the completion of ongoing research related to the ICI phenomenon, EASA do not intend to extend the current PAD by requesting operation "with the engine anti-icing system switched on unless it can be positively established that there is no possibility of encountering icing conditions, by flight through, adjacent to or below atmospheric conditions that might give rise to crystalline ice".*

No changes have been made to the Final AD in response to points B and C of this comment.

Commenter 3: Boeing – Sheila Montgomery – 19/08/2015**Comment # 3**

Boeing Commercial Airplanes has reviewed the subject EASA PAD and is providing [the following] comments. We would also like to add that one of the principles underlying the subject PAD is EASA's belief that the engine nose cone pressure sensor can be affected by icing in the absence of visible moisture. Boeing has tracked events involving engine nose cone pressure sensor icing, using information reported directly to Boeing by its customers, information Boeing has received via industry working groups, and information that Boeing has independently developed. The information available to Boeing indicates that visible moisture has been present in all known engine nose cone pressure sensing icing events. There is therefore a fundamental inconsistency in the relative understandings of EASA and Boeing as to how these events occur. During the initial review of the subject PAD, Boeing advised EASA that, based on our knowledge base, visible moisture must be present for engine nose cone pressure sensing icing to occur. EASA rejected Boeing's comments on the grounds that such icing can occur without visible moisture. Before the PAD is issued, Boeing strongly recommends and encourages a face-to-face meeting of the appropriate EASA, FAA, and Boeing subject matter experts, and others as required, to discuss this issue, share data, and, if possible, reach an understanding in the technical community as to whether visible moisture must be present for engine nose cone pressure sensing icing to occur. Boeing is willing to travel to send its experts to a mutually convenient site for such a meeting.

[A] What does the commenter request?

Withdraw the Proposed Airworthiness Directive, or replace it with a reminder to flight crews to follow the existing procedures relating to the use of anti-icing systems.

How is the request justified?

Boeing respectfully recommends that EASA withdraw the Proposed Airworthiness Directive calling for changes to the MD-80 Airplane Flight Manual (AFM) because the existing procedures in the MD-80 Flight Crew Operations Manual (FCOM) are sufficient to address the risks posed by icing of the engine nose cone pressure sensor, also called the PT2 sensor. The possible effect of icing on the engine nose cone pressure sensor is covered by the existing manuals. Boeing advises operators through the FCOM to activate engine anti-ice whenever the outside air temperature is less than 6 degrees Celsius and visible moisture is present (Please see MD-80 FCOM Normal Procedure for "Engine Anti-Ice on Ground and in Flight"). If flight crews follow Boeing's recommended procedure, then the engine anti-ice system would be active in any conditions that could result in icing. Because use of the engine anti-ice system eliminates the risk of icing of the engine nose cone pressure sensor, the existing engine anti-ice procedure is sufficient to eliminate the risks that the proposed safety recommendation seeks to address. A reminder to operators to instruct their flight crews to follow Boeing's recommended procedure for use of the engine anti-ice system would be more appropriate than requiring a new procedure.

List paragraphs that change; describe (nonobvious) changes.

If EASA is unwilling to withdraw the proposed airworthiness directive, or to replace it with a reminder to follow existing procedures, then Boeing recommends that the proposed Appendix 1-Normal Procedures checklist in PAD 15-099 be amended to the following:

"WARNING:

Engine nose cone pressure sensor icing can occur at temperatures of 6 degrees Celsius TAT and below when visible moisture is present. Visible moisture is defined as any clouds, mist, fog, rain, snow, or ice that is visible to the pilots, regardless of the amount thereof. Visual indications of moisture include:

- *Thin cirrus clouds;*
- *Spindrift from convective clouds;*
- *Rain on the windscreen at temperatures too cold for liquid water to exist, due to ice crystals melting on the heated windows;*
- *Heavy rain below the aircraft, identified by amber and red on weather radar. (It should be noted there may be no significant radar returns at aircraft altitude.)*

Some types of icing may not appear on radar due to its low reflectivity.

This condition can generate a false EPR indication causing the autothrottle to reduce N1 to maintain the erroneous EPR within the limit. This can result in a loss of

airspeed and an increase in airplane pitch over time. If not identified by the crew, a stall or a near stall condition may develop.

During flight, particularly when flying near convective clouds, engine anti-ice should be used as appropriate for the existing environmental conditions.

If erroneous EPR data is confirmed, the abnormal procedure on “Unreliable EPR Indications” as defined in Appendix 2 of this PAD shall be used. “

In addition, the Appendix 2-Abnormal Procedures checklist in PAD 15-099 should be replaced with the equivalent existing procedure from the Flight Crew Operations Manual.

[B] What does the commenter request?

Deletion of the unsupported statement that icing of the engine nose cone pressure sensor in the absence of visible moisture.

How is the request justified?

Boeing is unaware of any events when the engine nose cone pressure sensor was affected by icing in the absence of visible moisture. Visible moisture is defined as any clouds, mist, fog, rain, snow, or ice that is visible to the pilots, regardless of the amount thereof. Visual indications of moisture can include:

- Thin cirrus clouds;
- Spindrift from convective clouds;
- Rain on the windscreen at temperatures too cold for liquid water to exist, due to ice crystals melting on the heated windows;
- Heavy rain below the aircraft, identified by amber and red on weather radar. (It should be noted there may be no significant radar returns at aircraft altitude.)

For example, in the Air Algérie accident, the airplane encountered and attempted to divert around a storm cell. In so doing, the aircraft is believed to have encountered cold and wet air and visible moisture is believed to have been present. There is no data that justifies the statement that icing of the engine nose cone pressure sensor can occur in the absence of visible moisture.

One of the principles underlying the subject PAD is EASA's belief that the engine nose cone pressure sensor can be affected by icing in the absence of visible moisture. Boeing has tracked events involving engine nose cone pressure sensor icing, using information reported directly to Boeing by its customers, information Boeing has received via industry working groups, and information that Boeing has independently developed. The information available to Boeing indicates that visible moisture has been present in all known engine nose cone pressure sensing icing events. There is therefore a fundamental inconsistency in the relative understandings of EASA and Boeing as to how these events occur.

During the initial review of the subject PAD, Boeing advised EASA that, based on our knowledge base, visible moisture must be present for engine nose cone pressure sensing icing to occur. EASA rejected Boeing's comments on the grounds that such icing can occur without visible moisture. Before the PAD is issued, Boeing strongly recommends and encourages a face-to-face meeting of the appropriate EASA, FAA, and Boeing subject matter experts, and others as required, to discuss this issue, share data, and, if possible, reach an understanding in the technical community as to whether visible moisture must be present for engine nose cone pressure sensing icing to occur. Boeing is willing to travel to send its experts to a mutually convenient site for such a meeting.

List paragraphs that change; describe (nonobvious) changes.

Amend first two sentences of first paragraph of proposed Appendix 1-Normal Procedures in PAD 15-099 as follows:

Engine nose cone pressure sensor icing can occur, ~~even with no visible moisture~~, particularly near convective clouds. Some icing may ~~This type of icing does not appear on radar due to its low reflectivity, and neither the airplane ice detector (when installed) may not nor visual indications indicate the presence of icing conditions.~~

[C] What does the commenter request?

Revise/Update the Boeing contact information should questions arise concerning the technical content of the requirements in this PAD.

How is the request justified?

The location and phone/fax information of the Boeing Data & Services Management has changed.

List paragraphs that change; describe (nonobvious) changes.

Revise Remarks item #3 as follows:

For any question concerning the technical content of the requirements in this PAD, please contact:

Boeing Commercial Airplanes, Attention: Contractual & Data Services, 2201 Seal Beach Blvd., MC 110-SK57, Seal Beach, California 90740-1515, United States of America; Telephone: +1 562-797-1717; Internet <https://www.myboeingfleet.com>.

EASA response:

[A] Comment partially agreed. EASA do not agree to withdraw the current PAD or to replace it with a reminder to flight crews to follow the existing procedures relating to the use of anti-icing systems. As FCOM is not type design approved data and may vary between Operators, EASA consider that there is no guaranteed equivalent Abnormal Procedure in all FCOMs used by European Operators sufficiently addressing the risks posed by icing of the engine nose cone pressure sensor.

EASA also consider that the additional requirement to monitor thrust by checking the correlation of N1 vs EPR is adding an additional layer of protection for the detection of erroneous EPR by the flight crew.

However, EASA intend to introduce the amended definition of visible moisture as well as some parts of the proposed text provided in the above comment from Boeing to the Appendix 1 of the AD to read as follows (changes to the wording used in PAD 15-099 is indicated in red, text shaded in yellow is considered for future AD action, provided the statements 1 and 2 below have been confirmed):

“WARNING:

Engine nose cone pressure sensor icing can occur at temperatures of 6 degrees Celsius TAT and below when visible moisture is present. Visible moisture is defined as any clouds, mist, fog, rain, snow, or ice that is visible to the pilots, regardless of the amount thereof. Visual indications of moisture include:

- Thin cirrus clouds;**
- Spindrift from convective clouds;**
- Rain on the windscreen at temperatures too cold for liquid water to exist, due to ice crystals melting on the heated windows;**
- Heavy rain below the aircraft, identified by amber and red on weather radar. (It should be noted there may be no significant radar returns at aircraft altitude.)**

However, indication of visible moisture might be missed by the flight crew.

Engine nose cone pressure sensor icing **may also** occur, even with no visible moisture, particularly near convective clouds. This type of icing **may** not appear on radar due to its low reflectivity, and neither the airplane ice detector (when installed) nor visual indications **may** indicate the presence of icing conditions.

This Any condition leading to engine nose cone pressure sensor icing can generate a false EPR indication causing the auto-throttle to reduce N1 to maintain the erroneous EPR within the limit. If not promptly identified by the **flight** crew the aircraft can rapidly lose **airspeed, increase aircraft pitch over time** developing a stall or a near stall condition.

During flight, particularly when flying near convective clouds, monitor airspeed and thrust. For monitoring of thrust the flight crew shall check the correlation of N1 vs EPR by using applicable (S)TC Holder data.

If erroneous EPR data is confirmed, the abnormal procedure on “Unreliable EPR Indications” as defined in Appendix 2 of this AD shall be used.”

In order to support the introduction of the above part related to the condition of Engine nose cone pressure sensor icing in presence of visible moisture (see text shaded in yellow above) to future potential revision of the subject AD, evidence should be provided to confirm that:

- 1) *The extended definition of visible moisture including the 3rd bullet above is in accordance with the actual AFM definition.*
- 2) *The activation of ENG ANTI-ICE in the conditions described under the 3rd bullet above cannot lead to other implications.*

[B] *Comment not agreed. EASA confirm that the main principle underlying the subject PAD is EASA’s belief that the engine nose cone pressure sensor might be affected by icing in the absence of visible moisture. As indicated in the chapter “Reason” of the current PAD this is based on a number of operational events having occurred on aeroplanes of the DC-9 type design, where the engine nose cone pressure sensor had frozen without the flight crew being aware that they were flying in icing conditions.*

In their above comment Boeing state that:

“For example, in the Air Algérie accident, ... visible moisture is believed to have been present. There is no data that justifies the statement that icing of the engine nose cone pressure sensor can occur in the absence of visible moisture.” Referring to the number of operational events and specifically to the latest Air Algérie accident EASA remind that there is also no data that justifies a statement that icing of the engine nose cone pressure sensor cannot occur in the absence of visible moisture. Therefore, EASA prefer to provide the last safety net by:

- 1) *increasing the flight crew awareness on the implications of engine nose cone pressure sensor icing to safety of flight,*
- 2) *enhancing the flight crew capability to identify erroneous EPR data and*
- 3) *to provide clear procedures to be followed in case that unreliable EPR indications have been identified.*

EASA will proceed with the publication of the Final AD. But EASA will be prepared to reconsider our position in case we are provided with data justifying the statement that icing of the engine nose cone pressure sensor cannot occur in the absence of visible moisture. See also EASA response to point [A] above.

No changes have been made to the Final AD in response to this comment.

[C] *Comment agreed. The contact address details in the Final AD have been updated accordingly.*

Commenter 4: Comisión de Investigación de Accidentes e Incidentes de Aviación Civil (Spain) – CIAIAC Secretariat – 20/08/2015

Comment # 4

We would like to present some comments to your PAD nº 15-099 for your consideration based in our investigation experience.

- [A]** We notice that in the EASA document, in the section “Reason”, the text says “...thus reducing thrust and causing a gradual but rapid loss of airspeed.” On the related operational events we realized that the speed dropping was not that fast, being over 20 minutes before recovery in one case and over 6 minutes on the other one before stalling. Due to this fact we suggest describing what happened with the speed to explain that it might be a gradual but continuous process.
- [B]** To clarify the idea showed on the Appendix 1 second paragraph we deemed it is not obvious for the crew to notice an erroneous EPR indication. In the Performance Manual (Boeing FCOM Vol VI-M May 15/14 rev 8) available to the related accident crew, we observed that there is not any chart that correlates EPR with N1 parameters in the cruise phase.

This also affects to the Appendix 2 procedure so that there is no way for a crew to determine which the Max Continuous N1 is due to the fact that pilots obtain this parameter only in EPR terms from the Thrust Rate Indicator TRI. There is no table or chart in the mentioned FCOM to determine the requested parameter to be applied as per the proposed procedure.

Even though the PAD encourage operators to contact Boeing or BFGoodrich Aerospace to obtain the correlation data of N1 vs EPR, we suggest requiring that these manufacturers should include these data in the AFM in a handy format to be used by crews during flight.

- [C]** Parallel to this issue it is our understanding that Boeing issued a 2002 Flight Operations Bulletin N° MD-80-02-02A after the Spirit Airlines N823NK event that focused on autopilot issues in this circumstances. It warned operators of the MD-80 fleet that "under some conditions, airspeed could decay to stall warning before the autopilot disconnects" and that if pilots set the autopilot to maintain altitude, they need to keep a close vigilance on airspeed. We believe these warnings should be included somehow in the EASA material. The EASA draft procedure, currently adds a new workload demand for monitoring which would probably be difficult to execute in actual flying conditions. Pilots experiencing ice crystals at high altitude are probably already under high workload, especially if at night without ground reference, if attempting to divert around weather, or if addressing communication issues, and pilots may routinely rely on the autothrottle and autopilot to help reduce workload and maintain situation awareness. As a consequence we suggest including a paragraph similar to the following: "Under some conditions, such as those involving ice crystals, the autopilot may not reliably monitor airspeed and, in fact, may bring the airplane to a stall without disengaging. Pilots must be aware that they cannot rely on the autopilot and autothrottle in these conditions for maintaining a stable orientation, and will benefit especially from enhanced monitoring techniques such as documented in this AD."

EASA response:

- [A]** *Comment agreed. The wording of the Final AD has been changed to read: "... causing a gradual loss of airspeed." (see also EASA response to point [A] of Comment #2).*
- [B]** *Comment agreed. EASA expect the (S)TC Holders will also include the requested correlation data of N1 vs EPR in the AFM(S). The wording of the Final AD has been clarified accordingly.*
- [C]** *EASA do not agree that the Normal Procedure defined in Appendix 1 of PAD 15-099 would add a new workload demand for monitoring which would probably be difficult to execute in actual flying conditions. It is EASA opinion that the subject procedure, when becoming part of the flight crew training, will help to prepare flight crews to identify engine nose cone pressure sensor icing and to take appropriate action when encountering such conditions.*

No changes have been made to the Final AD in response to point [C] of this comment.