U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of Accident Investigation and Prevention

800 Independence Avenue SW
Washington DC 20591

DEC 07 2011

Greg Smith
National Transportation Safety Board (NTSB), AS-40
490 L'Enfant Plaza East, SW
Washington, DC 20594

Dear Mr. Smith:

The Federal Aviation Administration (FAA) Flight Standards Service is providing the following response to your accident investigation information support request 12.010 pertaining to the American Airlines (AA) landing overrun at Jackson Hole, Wyoming, on December 29, 2010. Specifically you asked:

The FAA has improved oversight and inspection criteria for ensuring Title 14 Code of Federal Regulations (14 CFR) part 121 operators comply with the flight data recorder (FDR) system documentation requirements in 14 CFR section 121.344(j). On June 1, 2011, the FAA published a revision to the Flight Standards Information Management Systems, Air Transportation Oversight System (ATOS), Data Collection Tool Master List, Element Performance Inspection (EPI) and Safety Attribute Inspection (SAI) criteria. Among the changes in this revision, the FAA requires its inspectors to verify the operator maintains a document used to convert FDR recorded values to corresponding engineering units or discrete states and has an established correlation between the values being recorded by the flight data recorder and the corresponding values being measured. The FAA also added inspection criteria for overseeing compliance to the filtered flight data rule in 14 CFR section 121.346.

NTSB Question 1:

For an FDR installation in which parameters beyond the minimum set are recorded, how should those additional parameters be treated with respect to maintenance and inspection? Does that treatment change depending on if the parameter falls into the set of parameters required for newer aircraft , such as parameters that would be covered by 14 CFR section 121.344(d)(2), or if it is a parameter that is not listed in 14 CFR section 121.344(a) such as

documentary information about the flight or aircraft? (i.e. Are parameters required to be operational if connected?)

FAA Response: If an aircraft was certified to record more than the required set of parameters, then the operator is required to inspect and maintain all the parameters, including those beyond the mandatory parameters listed in 14 CFR section 121.344(a). The operator must maintain the certificated (airworthiness) state of the aircraft. The type or supplemental type certificate holder is required to provide instructions for continued airworthiness to maintain the certified configuration/state of each aircraft.

NTSB Question 2: What training is provided and/or required for inspectors overseeing FDR systems maintenance? Does that training include analysis of recorder data, and if so to what level of detail? If no training or analysis of the recorder data is given. How does the inspector ensure the validity of the FDR data the air carrier is providing for review to the inspector?

FAA Response: FAA Order 8900.1 Volume 4, Chapter 14, Section 8, Monitor Flight Data Recorder, paragraph 4-1529, Pre-Requisite and Coordination requires knowledge of the regulatory requirements of 14 CFR part 121, experience with equipment being inspected and completion of Airworthiness Inspector Indoctrination course. The FAA does not require specific training for inspectors overseeing FDR system maintenance. However, the FAA does provide FAA CBI Course 25813 "Digital Flight Data Recorder."

All inspectors with 14 CFR part 121 certificate holder oversight responsibilities additionally receive training in Air Transportation Oversight System (ATOS). These qualified inspectors are made aware of the requirement to use the element-related CFRs and the FAA policy/guidance necessary to perform inspections and answer Data Collection Tool (DCT) questions to validate the air carrier's program.

NTSB Question 3: Please provide a detailed explanation of the requirements and oversight of FDR system maintenance including:

a. Where the requirements for periodic operational checks are defined.
b. Where the requirements for periodic reasonableness checks are defined.
c. Where the requirements for inspections and the inspection intervals are defined.
d. How the inspection driven by ATOS SAI 1.3.1 question 1.48 ensures that the output of an operator's required procedures produces valid and correct documentation of the FDR system.
e. How the inspection driven by ATOS SAI 1.3.1 question 1.49 ensures that an operator's required procedures account for all required parameters and that all recorded data is valid and correct.

FAA Response: Prior to providing their assessment for the Principle Inspector (PI) to use in making risk-based decisions, inspectors are responsible to review and use the specific related element CFRs and policy/guidance to adequately respond to any individual DCT

question. The following FDR system maintenance requirements and oversight guidance are used by inspectors as the foundation for their assessment:

Regulatory references include:

- 121.343; Flight Data Recorders
- 121.344; Digital Flight Data Recorders for Transport Category Aircraft
- 121.153; Aircraft Requirements (TCDS reference)
- 121.346; Flight Data Recorders Filtered Data
- 121 Appendices B & M; Aircraft Flight Recorder Specifications
- OpSpec Paragraph D72; "Continuous Airworthiness Maintenance Program" - Regulatory requirement to comply with their OpSpec is 14 CFR 119.5(L)
- 121.373; Continuing and Analysis and Surveillance System (CASS)

Oversight references include:

- FAA Order 8900.1 Volume 6, Chapter 2, Section 28; "Monitor Continuous Airworthiness Maintenance Program/Revision"
- FAA Order 8900.1 Volume 4, Chapter 14, Section 8, Paragraph 4-1527 "Objective"
- FAA Order 8900.1 Volume 4, Chapter 14, Section 8, Paragraph 4-1528 "General"
- FAA Order 8900.1 Volume 4, Chapter 14, Section 8, Paragraph 4-1529, "Prerequisite and Coordination"
- FAA Order 8900.1 Volume 4, Chapter 14, Section 8, Paragraph 4-1531, "Monitoring Flight Data Recorders"
- Advisory Circular (AC) 20-141; Airworthiness and Operational Approval of Digital Flight Data Recorder Systems
- Advisory Circular (AC) 120-79; Developing and Implementing a Continuing and Analysis and Surveillance System (CASS)
- Advisory Circular (AC) 120-16; Air Carrier Maintenance Program

3. a. The requirements for periodic operational checks are included in the type or supplemental type certificate holder's instructions for continued airworthiness. Additionally, oversight guidance is provided in ATOS SAI DCT 1.3.1, Question 1.37, Advisory Circular 20-141, and Advisory Circular 120-16.

3. b. The requirements for periodic reasonableness check are included in the Type Design or Supplemental Type Certificate holder's instructions for continued airworthiness. Additionally, oversight guidance is provided in FAA Order 8900.1, Volume 4, Chapter 14, Section 8, Paragraphs 4-1526 through 4-1532, ATOS SAI DCT 1.3.1, Question 1.49, Job Task Item (JTI) #2, and Advisory Circular 20-141, Appendix 4.

3. c. The requirements for inspections and inspection intervals are included in the Type Design or Supplemental Type Certificate holder's instructions for continued airworthiness. Additionally, oversight guidance is provided in FAA Order 8900.1 Volume 4, Chapter 14,

Section 8, Paragraphs 4-1526 through 4-1532, ATOS SAI DCT 1.3.1, Question 1.49, Job Task Item (JTI) #1, Advisory Circular 20-141, and Advisory Circular 120-16.

3. d. and 3.e. The NTSB questions 3.d and 3.e reference SAI 1.3.1 questions and request functional results that are not found in the design of an SAI. The following is clarification of the SAI/EPI ATOS output function differences:

- EPI- To determine if the air carrier follows its procedures, controls, process measures, and interface for the process and determine if the process is functioning as designed to achieve the desired results.
- SAI- To help verify that the operator's documented procedures identify who, what, when, where, and how the operator accomplishes these procedures.

ATOS EPI DCT 1.3.1, question 1.37 and notes require an inspector to ask for procedures to create and maintain FDR correlation documentation in accordance with FAA advisory circular (AC) 20-141b. A specific note under question 1.37 requires the inspector to verify that the procedures describe an FDR correlation document which shows that the recorded data meets the required parameter range, sampling rate, resolution, and accuracy. The EPI 1.3.1 question 1.37 does not require that the inspector verifies compliance with each parameter's range, sampling rate, resolution, and accuracy, but instead requires that the inspector verifies that the operator has a correlation document that shows recorded data meets the sampling rate, range, resolution, and accuracy for each parameter.

ATOS EPI 1.3.1 question 1.37 and notes require inspectors to ask for procedures to ensure they identify, record, and verify required parameters are within the required sampling rate, range, resolution, and accuracy. Specific notes require the inspector to verify that the operator's maintenance program includes scheduled checks, including functional checks of dedicated sensors, and an FDR review that ensures recorded data is within the required range, sampling rate, resolution, and accuracy. The notes also require that the inspector verifies that the operator's maintenance program includes provisions for correcting any deficiencies found during a reasonableness check of the data. The EPI 1.3.1 question 1.37 ensures that an operator maintains its FDR system according to its maintenance program.

NTSB Question 4: Please provide copies of the EPI and SAI elements applicable to the FDR system of the incident aircraft as of the date of the incident

FAA Response: The ATOS Data Collection Tools (EPI and SAI questions) in effect of the time of the incident are provided below. See EPI and SAI in effect before June 1, 2011.

NTSB Question 5: I would also like to have a meeting to discuss the responses to these questions, particularly questions 1 and 3.

FAA Response: Flight Standards Service (AFS), Aircraft Certification Service (AIR), and Office of Accident Investigation and Prevention (AVP) representatives are willing to support a meeting at the request of the Board.

Element Performance Inspection (EPI) in effect before June 1, 2011

1.30	Did the operator maintain the Flight Data Recorder (FDR)? **Note(s):** *Verify the operator maintained a conversion document to convert recorded values to corresponding engineering units or discrete states. Is there an established correlation between the values recorded by the flight data recorder and the corresponding values being measured.* *Verify operator performed scheduled checks and FDR data review that ensures recorded data is within the required range, accuracy, and recording intervals.* *Verify the operator retained a minimum of 25 hours of aircraft operating data.* *Verify the operator retained FDR data and the recording media for 60 days (or longer at the request of the Board or the Administrator) in the event of an accident.* Updated: Rev. # 4 on 12/03/2009 Kind of Question:Flag, Supplemental, Domestic

Safety Attribute Inspection (SAI) in effect before June 1, 2011

1.37	Do procedures for Flight Data Recorder (FDR) Systems address the intent of AC 20-141A, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems, and FAA Order 8900.1, Volume 4, Chapter 14, Section 8, Monitor Flight Data Recorders? **Note(s):** *Verify the operator maintains a conversion document to convert recorded values to corresponding engineering units or discrete states. Verify there is an established correlation between the values recorded by the flight data recorder and the corresponding values being measured.* *Verify operator's program includes scheduled checks and FDR data review that ensures recorded data is within the required range, accuracy, and recording intervals.* *Verify the operator's program retains a minimum of 25 hours of aircraft*

	operating data. *Verify the operator's program requires the retention of FDR data and the recording media for 60 days (or longer at the request of the Board or the Administrator) in the event of an accident.* Updated: Rev. # 3 on 09/15/2009 SRRs: 121.343;121.344;121.344a;121.367;121 App..B;121 App..M Kind of Question: Flag, Supplemental, Domestic

Element Performance Inspection (EPI) in effect June 1, 2011

1.37	Did the operator maintain the Flight Data Recorder (FDR)? **Note(s):** *Verify a data conversion document is available and used to convert recorded values to corresponding engineering units or discrete states.* *Verify correlation between the values recorded by the flight data recorder and the corresponding values being measured.* *Verify FDR scheduled checks and data review have been accomplished to ensure recorded data is within the required range, accuracy, and recording intervals.* *Verify the operator maintained a record (for each airplane) that indicates if the parameters listed in 14 CFR part 121.346(c) are filtered, or not filtered. (This is required no later than October 21, 2011)* *Verify the operator maintained a record (for each airplane) that shows accurate and repeatable results of any reconstructed filtered parameter listed in 14 CFR part 121.346(c). (This is required no later than April 21, 2014)* *Verify the operator retained a minimum of 25 hours of aircraft operating data.* *Verify the operator retained FDR data and the recording media for 60 days (or longer at the request of the Board or the Administrator) in the event of an accident or NTSB reportable occurrence.* Updated: Rev. # 8 on 06/01/2011 Kind of Question: Flag, Supplemental, Domestic *Related Performance JTIs:* 1. Verify the operator maintains a document used to convert FDR recorded values to corresponding engineering units or discrete states and has an established correlation between the values being recorded by the flight

	data recorder and the corresponding values being measured. (JTI ID: 138) *Sources:* 121.344a(d); 121.344(j) FAA Order 8900.1, Volume 4, Chapter 14, Section 8; AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems 2. Verify the operator's scheduled FDR readouts show performance levels for ranges, accuracies, and recording intervals are maintained. Check for any missing parameters, data loss, or deterioration of signals. (JTI ID: 139) *Sources:* 121.344a; 121.Appendix B; 121.Appendix M; 121.344 FAA Order 8900.1, Volume 4, Chapter 14, Section 8; AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems 3. Verify the operator maintains a record to determine if any parameters listed in 14 CFR part 121.346(c) are filtered. The record must show this determination has been made for all the operator's airplanes and include any subsequent changes made to the FDR system. The record must be maintained as part of the correlation documentation required by 14 CFR part 121.344(j)(3). This action is required no later than October 20, 2011. (JTI ID: 140) *Sources:* 121.346(d)(1) AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems 4. Verify the operator maintains records (for each airplane) that shows accurate and repeatable results of any reconstructed parameter listed in 14 CFR part 121.346(c). The reconstructed parameter must meet the requirements of 14 CFR part 121 Appendix B or M. The operator's reconstruction procedure must have been approved by the FAA. This action is required no later than April 21, 2014. (JTI ID: 141)) *Sources:* 121.346(c); 121.346(d)(4) AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems

Safety Attribute Inspection (SAI) in effect June 1, 2011

1.48	Does the operator have procedures to create and maintain a document that is used to convert FDR recorded values to corresponding engineering units or discrete states? **Note(s):** *Verify procedures establish a correlation between the values recorded by the flight data recorder and the corresponding values being measured.* *The information can be contained in a hardcopy document or electronic format such as Flight Recorder Electronic Documentation (FRED).* Updated: Rev. # 9 on 06/01/2011	Yes No, Explain

	SRRs: 121.344a(d); 121.344(j) Kind of Question:Flag, Supplemental, Domestic *Related Design JTIs:* 1. Verify procedures describe a correlation document that shows recorded data meets the sampling rate, range, resolution, and accuracy for each parameter listed in 14 CFR part 121 Appendix B or M, as required. (JTI ID: 238) *Sources:* 121.344a(d); 121.344(j) AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems; FAA Order 8900.1, Volume 4, Chapter 14, Section 8	

1.49	Does the operator have procedures to ensure they identify, record, and verify required parameters are within the required sampling rate, range, resolution, and accuracy? **Note(s):** *The operator must identify and record all the required parameters for each of their aircraft.* Updated: Rev. # 9 on 06/01/2011 SRRs: 121.344a; 121.Appendix B; 121.Appendix M; 121.344 Kind of Question:Flag, Supplemental, Domestic *Related Design JTIs:* 1. Verify the operator's maintenance program includes scheduled checks and FDR data review that ensures recorded data is within required range, accuracy, and recording intervals. (JTI ID: 239) *Sources:* 121.344a; 121.Appendix B; 121.Appendix M; 121.344 AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems; FAA Order 8900.1, Volume 4, Chapter 14, Section 8 2. Verify the operator's maintenance program includes provisions for correcting any deficiencies found during a reasonableness check of the data. This check is to ensure that the recorded parameters provide the data that is reasonable for the phase of flight for which they were recorded. (JTI ID: 240) *Sources:* AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems; FAA Order 8900.1, Volume 4, Chapter 14, Section 8 3. Verify the operator's maintenance program includes a functional check of	

	dedicated sensors to the DFDR system. The program should indentify signals from parameter sources that cannot be verified during checks of the aircraft systems and equipment. (JTI ID: 241) *Sources:* AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems; FAA Order 8900.1, Volume 4, Chapter 14, Section 8

1.50	Does the operator have procedures to maintain a record (for each airplane) that indicates if the flight data recorder parameters listed in 14 CFR part 121.346(c) are filtered or not filtered? **Note(s):** *This is required no later than October 20, 2011.* *The operator must create a record of this determination for each airplane it operates and maintain it as part of the correlation documentation required by 14 CFR part 121.344(j)(3).* Updated: Rev. # 9 on 06/01/2011 SRRs: 121.346(d)(1)

1.51	Does the operator have FAA approved procedures required to accurately and repeatedly reconstruct the original sensor signal (for each airplane) of any filtered parameter listed in 14 CFR part 121.346(c)? **Note(s):** *This is required no later than April 21, 2014.* *The operator must submit their required reconstruction procedures and test results to the CHDO no later than April 22, 2013 for approval.* *The procedures are only needed for any filtered parameter listed in 14 CFR part 121.346(c) that requires reconstruction of the original sensor signal in order to meet the accuracy requirements of 14 CFR part 121 appendix B or M.* Updated: Rev. # 9 on 06/01/2011 SRRs: 121.346(c); 121.346(d)(3); 121.346(d)(4)

1.52	Do procedures require the retention of:

	• A minimum of 25 hours of recorded data, and • FDR data and recording media for 60 days in the event of an accident or NTSB reportable occurrence? **Note(s):** *Procedures must provide for the retention beyond 60 days at the request of the NTSB or the administrator.* Updated: Rev. # 9 on 06/01/2011 SRRs: 121.344a(e); 121.344(h); 121.344(i)

1.53	Do procedures for Flight Data Recorder (FDR) Systems address the intent of AC 20-141, Airworthiness and Operational Approval of Digital Flight Data Recorder Systems? Updated: Rev. # 9 on 06/01/2011

1.54	Do procedures for Flight Data Recorder (FDR) Systems address the intent of FAA Order 8900.1, Volume 4, Chapter 14, Section 8, Monitor Flight Data Recorders? Updated: Rev. # 9 on 06/01/2011

If you require additional information, please contact Ms. Kimberly Burtch, Accident Investigation Division, 202-493-4812.

Sincerely,

[redacted]

Robert Drake
Acting Manager, Accident Investigation Division