



U.S. Department of Transportation
Federal Aviation Administration
Washington, DC

Flight Standardization Board (FSB) Report

Revision: 4
Date: 05/03/2016

Embraer S.A.

Embraer 170/190

ERJ-170-100, ERJ-170-200, ERJ-190-100, ERJ-190-200, ERJ-190-100ECJ

Commercial Designations: ERJ-170, ERJ-175, ERJ-190, ERJ-195, Lineage 1000

Aaron J. Perkins
Chairman, Flight Standardization Board

Federal Aviation Administration
Seattle Aircraft Evaluation Group
1601 Lind Avenue SW
Renton, WA 98057-3356

Telephone: (425) 917-6600
FAX: (425) 917-6638

RECORD OF REVISIONS

Revision Number	Sections	Date
Original	ALL	04/05/2004
1	N/A	09/25/2005
2	N/A	08/10/2010
3	1,2,5,6,9,10, App 1, App 4	4/11/2014
4	ALL	05/03/2016

HIGHLIGHTS OF CHANGE

- Added Flaps 5 as a normal landing flap setting
- Added FFS to definitions section
- Revised term “check airman” to “check pilot”
- Revised term “pilot not flying” to “pilot monitoring”
- Deleted section 3.1.4
- Added FMS Load 27.1 training requirements in Section 6.5.3
- Added RNP AR training requirements in Section 6.5.4
- Added FANS 2 training requirements in Section 6.5.5
- Deleted section for Flight Navigator Training
- Added Appendix 8
- Minor grammatical changes throughout

TABLE OF CONTENTS

SECTION	PAGE
RECORD OF REVISION.....	2
HIGHLIGHTS OF CHANGE	3
TABLE OF CONTENTS.....	3
1. PURPOSE AND APPLICABILITY	5
2. PILOT TYPE RATING REQUIREMENTS	7
3. MASTER COMMON REQUIREMENTS (MCR)	7
4. MASTER DIFFERENCE REQUIREMENTS (MDR)	7
5. ACCEPTABLE OPERATOR DIFFERENCE REQUIREMENTS TABLES	8
6. FSB SPECIFICATIONS FOR TRAINING	8
7. FSB SPECIFICATIONS FOR CHECKING	15
8. FSB SPECIFICATIONS FOR CURRENCY	17
9. AIRCRAFT COMPLIANCE CHECKLIST	17
10. AIRCRAFT SIMULATOR AND FLIGHT TRAINING DEVICE COMPATIBILITY	19
11. APPLICATION OF FSB REPORT.....	20
12. ALTERNATE MEANS OF COMPLIANCE.....	20
13. MISCELLANEOUS	20
APPENDIX 1.....	21
APPENDIX 2.....	22
APPENDIX 3.....	23
APPENDIX 4.....	24
APPENDIX 5.....	25
APPENDIX 6.....	26
APPENDIX 7.....	30
APPENDIX 8.....	31

1. PURPOSE AND APPLICABILITY

1.1

This Flight Standardization Board (FSB) report specifies Federal Aviation Administration (FAA) master training, checking, and currency requirements applicable to crews operating the ERJ-170 and/or the ERJ-190 aircraft under Title 14 of the Federal Regulations (14 CFR). Provisions of this report are effective until amended, superseded, or withdrawn by subsequent FSB determinations and:

- a) Define a common pilot "type rating(s)" assigned to the ERJ-170 and ERJ-190,
- b) Describe any unique requirements applicable to initial, transition, upgrade, or recurrent qualification,
- c) Provide "Master Difference Program Requirements" for crews requiring differences qualification for mixed-fleet-flying or transition,
- d) Provide examples of acceptable "Operator Difference Requirement (ODR)" tables,
- e) Describe acceptable training program and flight simulation training device characteristics when necessary to establish compliance with pertinent Master Difference Requirements (MDR),
- f) Set checking and currency standards including specification of those checks that must be administered by FAA or operators, and
- g) List regulatory compliance status (compliance checklist) for 14 CFR parts 121, 91, 61, Advisory Circulars (AC), or other operationally related criteria reviewed by the Aircraft Evaluation Group (AEG) or FSB.

1.2

This report includes:

- a) Minimum requirements which must be applied by FAA field offices, (e.g. MDR, Type Rating designations, etc.),
- b) Information which is advisory in general, but is mandatory for particular operators if the designated configurations apply and if approved for that operator (e.g. MDR footnotes, acceptable ODR tables), and
- c) Information which is used to facilitate FAA review of an aircraft type or variation that is proposed for use by an operator (e.g. compliance checklist).

Various sections within the report are qualified as to whether compliance is recommended, advisory, or required, considering the provisions in the current revision of AC 120-53.

1.3

Acronyms

AC	Advisory Circular
AEG	Aircraft Evaluation Group
AOM	Aircraft Operating Manual
AQP	Advanced Qualification Program
ATPC	Airline Transport Pilot Check
CFIT	Controlled Flight Into Terrain
CFR	Code of Federal Regulations
CHDO	Certificate Holding District Office
EICAS	Engine Indication and Crew Alerting System
FADEC	Full Authority Digital Electronic Control
FBS	Fixed Base Simulator
FFS	Full Flight Simulator
FMS	Flight Management System
FSB	Flight Standardization Board
FSTD	Flight Simulation Training Device
FTD	Flight Training Device
GPS	Global Positioning System
HUD	Head-Up Display
IAW	In Accordance With
LOE	Line Operational Evaluation
LOFT	Line Oriented Flight Training
MCR	Master Common Requirements
MDA	Minimum Descent Altitude
MDR	Master Differences Requirements
MFD	Multi Function Display
NSP	National Simulator Program
ODR	Operator Difference Requirements
PFD	Primary Flight Display
POI	Principal Operations Inspector
PTS	Practical Test Standards
TSO	Technical Standard Order

1.4

This report addresses ERJ-170 (A56NM) and ERJ-190 (A57NM) variations as specified in the FAA Type Certificate Data Sheets (TCDS). These include the following: ERJ-170-100, ERJ-170-200, ERJ-190-100, ERJ-190-200, and ERJ-190 ECJ. The ERJ-170-100, ERJ-170-200, and ERJ-190-100, ERJ-190-200 are often commercially referred to as the Embraer 170, Embraer 175, and the Embraer 190, Embraer 195 respectively.

1.5

Relationship between this FSB report and an Advanced Qualification Program (AQP) program. Differences between this FSB report and an operator's proposed training, checking, and currency requirements under an AQP, must be justified and documented as part of the applicant's AQP

approval process. Program approvals under AQP need to ensure the basic provisions and requirements of this report have been addressed and, where necessary, coordination with the appropriate Flight Standardization Board has been completed.

2. PILOT "TYPE RATING" REQUIREMENTS

The pilot type rating for the Embraer 170 is "ERJ-170" and the pilot type rating for the Embraer 190 is "ERJ-190". In accordance with the provisions of the current revision of AC 120-53, the Embraer 170 and the Embraer 190 are identified as having common type ratings.

3. "MASTER COMMON REQUIREMENTS" (MCR)

3.1

Common requirements for all ERJ-170/ERJ-190 airplanes.

3.1.1

Landing Minima Categories, 14 CFR § 97.3. All ERJ-170/ERJ-190 airplanes are considered Category C aircraft for the purposes of determining "straight-in landing weather minima". For circling, the minima to be used are as specified in operation specifications for each operator as follows:

- a) For operators with Operations Specifications (Paragraph C075), circling minima are as specified for the actual approach speed to be used for a circling maneuver, or
- b) If operations specifications have not been issued, circling minima are as designated by 14 CFR § 97.3.

3.1.2

Normal "Final Landing Flap Setting", 14 CFR § 91.126(c). The normal "final landing flap setting" per 14 CFR § 91.126(c) is considered to be either Flaps 5 or Flaps Full for all ERJ-170/ERJ-190 airplanes.

3.1.3

Autopilot Engage/Disengage Altitudes. The autopilot must not be engaged below a minimum engage altitude of 400 feet AGL after takeoff. The autopilot must be disengaged before the airplane descends below 50 feet AGL when it is coupled to an ILS glideslope and localizer unless it is in the go-around mode. The autopilot must be disengaged before the airplane descends below Minimum Descent Altitude (MDA) on a non-precision approach with the autopilot engaged.

4. "MASTER DIFFERENCE REQUIREMENTS" (MDR)

4.1

Requirements for particular ERJ-170/ERJ-190 Combinations. Master Difference Requirements (MDR) for variations of the ERJ-170/ERJ-190 are shown in Appendix 1. These provisions apply

when differences between aircraft variations exist which affect crew knowledge, skills, or abilities related to flight safety (e.g., Level A or greater differences).

4.2

MDR Footnotes. Footnotes to MDR requirements define acceptable "required means" or "alternate means" of compliance. A footnote can indicate requirements that are less restrictive than the basic designation, or more restrictive than the basic designation, depending on the significance of the differences between particular aircraft variations.

4.3

Terminology. The term "must" is used in this report and certain MDR Footnotes even though it is recognized that this FSB report, and AC 120-53, as amended, on which it is based, provides one acceptable means, but not necessarily the only means of compliance with 14 CFR part 121 Subparts N and O requirements. This terminology acknowledges the need for operators to fully comply with provisions in this FSB report, if this AC method is to be applied as that operator's means of compliance with 14 CFR part 121. Operators who choose this method must comply with each applicable MDR provision including footnotes. Partial, or selective application of the process or its provisions, does not constitute an acceptable means of compliance with 14 CFR part 121 under AC 120-53, as amended.

5. ACCEPTABLE "OPERATOR DIFFERENCE REQUIREMENTS" (ODR) TABLES

5.1

ODR Tables. ODR tables are used to show an operator's compliance method. Detailed Embraer generic ODR tables are on file with the Seattle AEG. Copies are available on request. These ODR tables are provided as Embraer generic, and therefore may not include items that are applicable to particular operators.

5.2

Operator Preparation of ODR Tables. Operators flying "mixed fleet" variations and types must have approved ODR tables pertinent to their fleet.

5.3

ODR Table Coordination. New ODR tables proposed by operators should be coordinated with the FSB prior to FAA approval and implementation. Through this coordination, the FSB can ensure consistent treatment of variations and types between various operators and compatibility of the ODR tables with MDR provisions.

5.4

ODR Table Distribution. Originally approved ODR tables are retained by the operator. Copies of approved ERJ-170/ERJ-190 ODR tables are retained by the Certificate Holding District Office (CHDO). Copies of all approved ODR tables should be forwarded to the FSB Chairman, Seattle AEG.

6. FSB SPECIFICATIONS FOR TRAINING

6.1 General

6.1.1

Assumptions Regarding Airmen's Previous Experience. The provisions of Section 6 of this report apply to programs for airmen who have experience in 14 CFR part 121 or 135 air carrier operations and multi-engine transport turbojet or turboprop aircraft. For airmen not having this experience, additional requirements may be appropriate as determined by the Principal Operations Inspector (POI), FSB, and the Flight Standard Air Transportation Division, AFS-200.

6.1.2

ERJ-170/ERJ-190 Full Course programs. Principal Inspectors for operators initially introducing a ERJ-170/ERJ-190 type, may approve programs consistent with programs previously approved. For information regarding previously approved programs, FAA Principal Inspectors for other existing ERJ-170/ERJ-190 operators may be consulted. In the event of uncertainty regarding evaluation of a proposed program, the FSB should be consulted.

6.2

Pilots Initial, Transition and Upgrade Ground Training

6.2.1

Pilots: Initial, Transition and Upgrade Ground Training. Initial, transition, or upgrade ground training for the ERJ-170/ERJ-190 is accomplished as specified by 14 CFR. No unique provisions or requirements are specified. Training program hours may be reduced as specified in 14 CFR § 121.405.

6.2.2

Pilots: Initial, Transition and Upgrade Flight Training. Initial, transition, or upgrade flight training for the ERJ-170/ERJ-190 is accomplished as specified by 14 CFR. Training program hours may be reduced as specified in 14 CFR § 121.405.

6.2.2.1

Unique Training Provisions. All existing training requirements of 14 CFR part 121, Appendix E, are applicable to the ERJ-170 and ERJ-190 except as follows:

- Tuck and Mach buffet: Demonstration of the aircraft's overspeed protection capabilities is an acceptable substitute.
- Operation of systems and controls at the flight engineer station.
- Fuel jettisoning.

6.2.3

Crewmember Emergency Training. Crewmember emergency training should be conducted for the ERJ-170/ERJ-190 in accordance with 14 CFR. The objective of emergency training for the ERJ-170/ERJ-190 aircraft is to provide crewmembers with the necessary knowledge concerning

emergency equipment, situations, and procedures, to ensure implementation of the correct actions in the event of an emergency.

Emergency training consists of instruction on the location, function, and operation of emergency equipment that is different in each variation of the ERJ-170/ERJ-190 and from other aircraft in the operator's fleet. Where emergency equipment is common, instruction may be adjusted for crewmembers qualified and current on this equipment, provided records are available which demonstrate that crewmembers meet 14 CFR requirements. For example, if the fire extinguishers are common to fire extinguishers on other aircraft in the operator's fleet, training may be simultaneously credited for both aircraft. Conversely, for equipment that is unique to the ERJ-170/ERJ-190, training on the emergency equipment for each variation is required.

Emergency training also consists of instruction in crewmember emergency assignments and procedures including crew coordination and communication, the handling of emergency or other unusual situations, and emergency performance and observation drills that are specific to each variation of the ERJ-170/ERJ-190.

In accordance with FAA Order 8900.1, Flight Standards Information System (FSIMS), Volume 3, emergency training requirements refer to two types of training: "general" emergency training and "aircraft-specific" emergency training. General emergency training is instruction on those emergency items that are common to the ERJ-170/ERJ-190 and all aircraft in the operator's fleet, e.g., instruction on fire extinguishers and firefighting procedures, if common to all aircraft. Aircraft-specific emergency training is training on those items that are specific to the ERJ-170/ERJ-190 aircraft. An example of aircraft-specific emergency training is instruction on the location of emergency equipment for each variation of the ERJ-170/ERJ-190 aircraft.

As part of an approved training program, an operator may use many methods when conducting aircraft-specific emergency training, including classroom instruction, pictures, videotape, ground training devices, computer-based instruction, and static aircraft training.

There are no specified training program hours for Crewmember Emergency Training. A chart addressed in 8900.1 provides "national norms" for the approval of the general emergency training program hours. The complexity of the different variations of the ERJ-170/ERJ-190 aircraft and the complexity of the type of operation to be conducted should be considered when approving the ERJ-170/ERJ-190 aircraft-specific emergency training.

6.2.4

Areas of Emphasis. The following areas of emphasis should be addressed during ground and flight training:

- a) The engine indication and crew alerting system (EICAS), the primary flight displays (PFDs), and multifunction displays (MFDs). Altitude and airspeed are presented on vertical scale instruments in both digital and analog formats. Pilots need to be able to understand the multitude of information presented on these displays. Pilots transitioning from traditional round dial basic "T" instruments may require additional training and instrument scan practice to gain proficiency in manually flying by reference to the PFD.

Recognition of reversionary modes and display failures and appropriate corrective action to be taken should be addressed.

- b) Flight Control System. An operational understanding of the basic modes of operation as well as an understanding of the fly-by-wire primary and secondary flight control systems and their associated system components.
- c) Flight Guidance System including the Autopilot, Autothrottle, and Flight Director. An understanding of the various lateral and vertical modes and the ability to select and arm the modes during different phases of flight is essential.
- d) Full Authority Digital Electronic Control (FADEC). An operational understanding of the FADEC and the engine thrust mode selection is required.
- e) System control panels using pushbuttons with integral light bars. Pilots should have an understanding of the switch position and system configuration as it relates to whether the light bar is illuminated or not. This understanding is required for both normal and abnormal system operation.
- f) Head-Up Display (HUD). If Head-Up Displays are installed and used, training in accordance with Appendix 6 or equivalent should be provided. If mixed flying of HUD and non-HUD equipped aircraft occurs, the operator should have approved ODR tables reflecting the HUD installation.

6.2.5

Training for Seat Dependent Tasks. Accomplishment of certain tasks, procedures, or maneuvers require training of a crewmember for a particular crew position (i.e. captain, first officer, check pilot, etc.). Training programs should recognize and address the necessary seat/position related tasks for the applicable crewmember. Accordingly, training programs should address seat dependent tasks or maneuvers to the extent necessary to satisfy crew qualification objectives, and IAW ODR tables when applicable.

6.2.5.1

Features or Procedures Which Could Have Seat Dependent Elements (as determined by each operator and POI). These may include the following:

- a) Rejected Takeoff
- b) Emergency descent
- c) Manual gear extension

6.2.6

Special Event Training. Special event training is recommended for the ERJ-170/ERJ-190. Such training should be conducted to improve basic crew member understanding and confidence

regarding aircraft handling qualities, options and procedures as these relate to design characteristics and limitations. Examples of this training could include the following:

- a) Recovery from unusual attitudes
- b) Handling qualities and procedures during recovery from an upset condition (e.g., wake vortex encounter).

6.2.7

Controlled Flight Into Terrain (CFIT). Due to continued industry efforts to reduce exposure to CFIT accidents, special emphasis on this topic is appropriate. Emphasis on altitude awareness, GPWS warnings, situational awareness and crew coordination is appropriate.

6.3

Differences Training.

Differences training is required when a crewmember is qualified on a particular type of aircraft and seeks to serve in the same capacity on a particular variation of the same aircraft (e.g. ERJ-170-100, ERJ-170-200). The MDR table found in this report states the training level required for each variation of the ERJ-170 and ERJ-190. A training program addressing pertinent differences described by individual operator ODRs, including normal and abnormal operations, if applicable, is required for each aircraft flown.

An initial or transition training program for each variation can be substituted for a differences training program.

If training credit is sought between two different types of aircraft such as the ERJ-170 and the ERJ-190 then the provisions of 14 CFR § 121.418(b) apply.

6.4

Recurrent Training

6.4.1

Recurrent training must include appropriate training in accordance with 14 CFR.

For flight attendants, ERJ-170/ERJ-190 recurrent training consists of instruction as necessary in the ERJ-170/ERJ-190 general operational subjects, as addressed in Paragraph 6.5.2, Flight Attendants: Initial and Transition Ground Training, and in the ERJ-170/ERJ-190 aircraft-specific emergency subjects, as addressed in Paragraph 6.2.3, Crewmember Emergency Training.

As part of an approved training program, an operator may use many methods when conducting recurrent training, including classroom instruction, pictures, videotape, ground training devices, computer-based instruction, and static aircraft training.

Recurrent training must include a quiz or review to determine the state of the flight attendant's knowledge with respect to the duties and procedures required in routine, abnormal, and emergency situations for each variation of the ERJ-170/ERJ-190 aircraft. In addition, recurrent

training must include a competence check to determine flight attendant ability to perform assigned duties and responsibilities for the ERJ-170/ERJ-190 aircraft. The competence check should cover each piece of emergency equipment and each emergency procedure unique to each variation of the ERJ-170/ERJ-190 aircraft.

Training program hours for Recurrent Training may be reduced as specified in 14 CFR § 121.405.

6.4.2

Recurrent Ground Training Time Reductions. Recurrent ground training may be reduced below programmed hours required in 14 CFR § 121.427(c), in accordance with 14 CFR § 121.405.

6.4.3

Recurrent Flight Training. Recurrent flight training requires appropriate maneuvers and procedures identified in 14 CFR, for the ERJ-170/ERJ-190. Appropriate emphasis should be placed on systems and procedures that may not have been used operationally, and are expected to be used prior to the next recurrent training event (e.g. FMS, GPS, etc.). As permitted by 14 CFR § 121.427(d)(1)(ii), satisfactory completion of a proficiency check, in accordance with 14 CFR part 121, Appendix F, may be substituted for training.

6.4.4

Recurrent Training Level Adjustments. (Reserved)

6.5

Other Training

6.5.1

LOFT Programs, 14 CFR § 121.409(b)(3). When operators have LOFT programs, POIs should review those programs to assure their suitability.

6.5.2

Flight Attendants, Initial and Transition Ground Training, should be conducted in accordance with 14 CFR. The objective of aircraft ground training is to provide flight attendants with an understanding of the ERJ-170/ERJ-190 aircraft. This knowledge is necessary for the flight attendant to perform the duties and procedures required in routine, abnormal, and emergency situations.

Aircraft ground training includes instruction in two distinct subject areas: ERJ-170/ERJ-190 general operational subjects training and ERJ-170/ERJ-190 aircraft-specific emergency subjects training. The ERJ-170/ERJ-190 aircraft-specific emergency subjects training is addressed in paragraph 6.2.3, Crewmember Emergency Training.

ERJ-170/ERJ-190 general operational subjects training consists of instruction in the general description of the aircraft, aircraft equipment, furnishings, and systems; routine crewmember communication and coordination procedures; routine crewmember duties and procedures during

each phase of flight; and passenger handling responsibilities for each variation of the ERJ-170/ERJ-190 aircraft.

As part of an approved training program, an operator may use many methods when conducting aircraft ground training, including classroom instruction, pictures, videotape, ground training devices, computer based instruction, and static aircraft training.

Initial and Transition Ground Training must include a competence check to determine flight attendant ability to perform assigned duties and procedures on the ERJ-170/ERJ-190 aircraft. The competence check should cover each piece of emergency equipment and each emergency procedure unique to each variation of the ERJ-170/ERJ-190 aircraft.

Training program hours for Initial Ground Training may be reduced as specified in 14 CFR § 121.405; there are no specified training program hours for Transition Ground Training. The complexity of the different variations of the ERJ-170/ERJ-190 aircraft and the complexity of the type of operation to be conducted should be considered when approving ERJ-170/ERJ-190 Transition Ground Training.

6.5.3

Primus EPIC FMS Load 27.1 Training Requirements: The FSB has evaluated FMS Load 27.1 and determined a minimum of Level A training is required for all flight crews current in the ERJ-170/ERJ-190 aircraft. Level A training is defined in the current revision of AC 120-53.

6.5.4

RNP Procedures with AR. Operators need approval to conduct Required Navigation Performance with Authorization Required (RNP AR) instrument approach procedures. They are responsible to determine equipment needed, procedures, and training requirements based on the current revision of AC 90-101 specific to their operation. These requirements are submitted to their POI for approval. Operators are encouraged to develop an approach review/briefing card for use by flight crews when conducting any RNP AR operation.

RNP-AR operation is applicable to aircraft equipped with certified Primus EPIC Load 23.1, with not less than 0.3 nm for approach and not less than 1.0 nm for missed-approach. EPIC Load 27.1 (or later) together with NG-FMS is required for RNP-AR less than 0.3 nm for approach and/ or less than 1.0 nm for missed-approach.

6.5.4.1

Ground training for flight crews current in the ERJ-170/ERJ-190 aircraft was evaluated by an instructor-led course and should include subjects required by the current revision of AC 90-101.

6.5.4.2

Flight Training for flight crews current in the ERJ-170/ERJ-190 aircraft should be in accordance with the current revision of AC 90-101 and is established at Level D. The operator may conduct required flight-training modules in Flight Training Devices (minimum of level 6) that replicate the operator's equipment and RNP AR approach operations.

6.5.5

FANS 2. The FSB has established the training and checking requirements at level B as outlined in the current revision of AC 120-53. The currency requirements are established at level A as outlined in the current revision of AC 120-53. An operator intending to use Data Link Communication service should obtain an operational authorization that should address flight crew training and qualification.

The operator should also ensure that aircraft equipment has been approved for the intended use. The specific training program should contain the training items as outlined in the current revision of AC 120-70. The training should consider the policies and procedures for flight crew involved in data link operations incorporated in the respective operations manuals. The training should contain:

- Knowledge of concepts, systems and procedures (academic training)
- Required communication performance and loss of communications
- Knowledge and skills to properly respond to data link communications clearances and advisories (operational use training)
- Human factors and CRM issues (e.g. head-down time, situational awareness)

Operator's program should be applied as a separate module or integrated with initial, transition, upgrade, recurrent, differences or general training.

6.5.6

Aircraft Dispatchers, Initial and Transition should be conducted in accordance with 14 CFR § 121.422.

7. FSB SPECIFICATIONS FOR CHECKING

7.1

General

7.1.1

Checking Items. Pertinent knowledge, procedures, and maneuvers specified by 14 CFR part 61, FAA Practical Test Standards (PTS) and 14 CFR part 121, Appendix F, pertinent to multi-engine turbojet transport aircraft apply.

7.1.2

Areas of emphasis. The following areas of emphasis should be addressed during checks as necessary:

- a) Proficiency with manual and automatic flight must be demonstrated.
- b) Proper selection and use of PFD/MFD displays, raw data, flight director, and Flight Guidance System modes should be demonstrated, particularly during instrument approaches.

- c) Demonstration of FMS navigation (departures and arrivals) proficiency.
- d) Proper outside visual scan without prolonged fixation on FMS operation should be demonstrated, and failure of component(s) of the FMS should be addressed.

7.1.3

No Flap Landings. Demonstration of a No Flap approach and landing during a 14 CFR part 61 or 14 CFR part 121, Appendix F, check is appropriate. In accordance with FAA Order 8900.1, when the flight test is conducted in the airplane in actual flight, a touchdown from a no flap is not required. The approach must be flown to the point where the inspector or examiner can determine whether the landing would or would not occur in the touchdown zone.

7.1.4

Head-Up Display (HUD).

- a) When HUD use is approved, checking must include suitable demonstration of HUD use for modes and phases of flight authorized. Checking standards for HUD are equivalent to those for non-HUD operations.
- b) HUD vs. Flight Director and Raw Data. When HUD is installed, PC maneuvers, LOFT or other demonstrations may be completed using HUD at the check pilot/inspector's discretion. However, periodic assessment of non-HUD skills should be demonstrated, and at any time a check pilot/inspector may at their discretion request that authorized maneuvers be performed without use of HUD (e.g. if manual CAT I F/D operations are authorized, the airman being checked may be requested to perform the maneuver without HUD).

7.2

Type Ratings

7.2.1

Oral Examinations. When an airman is qualifying in only the ERJ-170 or ERJ-190, oral test items need only address the model for which the test is being conducted.

7.2.2

Practical Tests. The satisfactory completion of a practical type rating evaluation in any ERJ-170 or ERJ-190 variation will meet the requirement for the ERJ-170, ERJ-190 type rating. In order to operate another variation, crews operating under 14 CFR part 121 are required to satisfactorily comply with the requirements of the MDR and ODR tables in Appendices 1 and 2. The same requirement should be followed by flight crewmembers operating under 14 CFR part 91, 125 or 135.

7.2.3

Application For and Issuance of Type Ratings. Airmen completing pertinent 14 CFR part 61 requirements in either a ERJ-170 or ERJ-190 variation in accordance with FSB requirements described in this report, may apply to the FAA for the ERJ-170, ERJ-190 type rating

endorsement. Upon completion of required tests, and submission of an application (FAA Form 8710-1), authorized FAA inspectors or designees may issue the necessary pilot certificate with type rating.

7.3 Proficiency Checks

General. Proficiency Checks are administered as designated in 14 CFR § 121.441 and 14 CFR part 121, Appendix F, for the ERJ-170/ERJ-190. A proficiency check in either the ERJ-170 or ERJ-190 suffices for the type, if initial and recurrent qualification is conducted IAW MDR and approved ODR tables for that operator. These checks must be administered by an authorized check pilot, or FAA Aviation Safety Inspector. Satisfactory completion of a proficiency check may be substituted for recurrent flight training as permitted in 14 CFR § 121.433(c).

8. FSB SPECIFICATIONS FOR CURRENCY

8.1
Currency Required by FAR § 121.439 is addressed separately unless otherwise approved. For programs approved through ODR tables, currency is specified in accordance with MDR.

8.2
Currency criteria for mixed fleet operations. These are shown in MDR/ODR tables. Takeoff and landing credit is permitted between ERJ-170 and ERJ-190 variations. Takeoffs and landings performed in one aircraft variation are equivalent to those performed in the other aircraft variation.

9. AIRCRAFT COMPLIANCE CHECKLIST

9.1
Compliance Checklist (see Appendix 4).

EMBRAER has not provided the FSB with a complete compliance checklist to identify those specific operating rules or policies for which the ERJ-170/ERJ-190 complies. It is the responsibility of the Certificate Holding District Office (CHDO) to review compliance with pertinent operating rules prior to 14 CFR part 121 approval for an operator to use the ERJ-170/ERJ-190 in service.

9.2
Discussion of Specific Compliance Checklist Items

9.2.1
ERJ-170/ERJ-190 Observer Seat. On ERJ-170/ERJ-190 aircraft, the observer seat complies with the requirements of 14 CFR § 121.581.

9.2.2
Emergency Evacuation.

- a) ERJ-170-100. The ERJ-170-100 has successfully been demonstrated under 14 CFR § 121.291 for configurations and passenger capacities up to 78 passengers with a minimum of 2 Flight Attendants. Accordingly, an additional 14 CFR § 121.291 full scale evacuation is not necessary for aircraft configurations consistent with previously approved tests. Passenger capacity less than or equal to the demonstrated capacity may be authorized. A partial-evacuation for the ERJ-170-100 is required unless the particular certificate holder has previously operated a ERJ-170-100 with the same or similar interior and exit configuration.
- b) ERJ-170-200. A maximum passenger capacity of 88 has been approved for the ERJ-170-200 based on the emergency evacuation demonstration IAW 14 CFR § 121.291 that was conducted for the ERJ-170-100. Accordingly, an additional 14 CFR § 121.291 full scale evacuation is not necessary for aircraft configurations consistent with previously approved tests. Passenger capacity less than or equal to the demonstrated capacity may be authorized. A partial-evacuation for the ERJ-170-200 is required unless the particular certificate holder has previously operated a ERJ-170-200 with the same or similar interior and exit configuration.
- c) ERJ-190-100. The ERJ-190-100 has successfully been demonstrated under 14 CFR § 121.291 for configurations and passenger capacities up to 110 (through S/N 190-00348) and 112 (S/N 190-00349 and on) passengers with a minimum of 3 Flight Attendants. Accordingly, an additional 14 CFR § 121.291 full scale evacuation is not necessary for aircraft configurations consistent with previously approved tests. Passenger capacity less than or equal to the demonstrated capacity may be authorized. 14 CFR § 121.391 addresses the minimum number of flight attendants required for the actual seating capacity. A partial-evacuation for the ERJ-190-100 is required unless the particular certificate holder has previously operated an ERJ-190-100 with the same or similar interior and exit configuration.
- d) ERJ-190-200. The ERJ-190-200 has successfully been demonstrated under 14 CFR § 121.291 for configurations and passenger capacities up to 124 passengers with a minimum of 3 Flight Attendants. Accordingly, an additional 14 CFR § 121.291 full scale evacuation is not necessary for aircraft configurations consistent with previously approved tests. Passenger capacity less than or equal to the demonstrated capacity may be authorized. 14 CFR § 121.391 addresses the minimum number of flight attendants required for the actual seating capacity. A partial-evacuation for the ERJ-190-200 is required unless the particular certificate holder has previously operated a ERJ-190-200 with the same or similar interior and exit configuration.

9.2.3

Proving Tests, 14 CFR § 121.163. Initial 14 CFR part 121 proving tests in accordance with provisions of 14 CFR § 121.163 (a) for the ERJ-170-100 are based on an approved program completed by U.S. Airways.

Proving tests in accordance with 14 CFR § 121.163 (b) are appropriate in accordance with FAA Order 8900.1, Vol. 3, Chapter 29, when the ERJ-170/ERJ-190 is new to a particular operator. Proving test requirements and reductions are as designated by FAA Order 8900.1 and the CHDO, or as otherwise specified by the FSB or AFS-200.

9.2.4

Ditching Demonstration 14 CFR § 121.291.

- a) ERJ-190-100 - Documentation provided to the FSB indicates the ERJ-190-100 received credit for a full scale ditching demonstration in accordance with 14 CFR § 121.291(d) and FAA Order 8900.1, Vol 3, Chapter 30, Section 4. A partial-ditching demonstration for the ERJ-190-100 is required in accordance with 14 CFR § 121.291(e).
- b) ERJ-190-200 - A full scale ditching demonstration in accordance with 14 CFR § 121.291(d) and FAA Order 8900.1, Vol 3, Chapter 30 has NOT been accomplished by a Part 121 operator. Subsequent to a full scale demonstration a partial-ditching demonstration for the ERJ-190-200 is required in accordance with 14 CFR § 121.291(e).

10. FSB SPECIFICATIONS FOR FLIGHT TRAINING DEVICES AND FULL FLIGHT SIMULATORS

10.1 Flight Training Device And Full Flight Simulator Characteristics. Flight training device (FTD) and full flight simulator (FFS) characteristics pertinent to the ERJ-170/ERJ-190 are as specified by 14 CFR § 121.407, 14 CFR part 121, Appendix H, and 14 CFR Part 60, except as described below.

10.2

Use of FTDs for Specific Check/Evaluation Items. Certain ATP, type rating, or proficiency check/evaluation items may be completed in FAA qualified FTDs. This is appropriate for items such as FMS initialization (e.g., 14 CFR part 61, or engine start non-normals). Specific checking credit in such instances must be in accordance with part 121 Appendix F and be approved by the POI.

10.3

Full Flight Simulator And Flight Training Device Compatibility (Ref 14 CFR § 121.407). When variations are flown in mixed fleets, the combination of FFS and FTDs used to satisfy MDR or ODR provisions must match specific variations flown by that operator. The acceptability of differences between FTDs, FFS, and aircraft operated must be addressed by the POI.

10.4

Flight Training Device Approval. Requests for FTD approval should be made to the POI in accordance with 8900.1 guidance. If FTD characteristics clearly meet established FAA criteria and are qualified, the POI may approve those devices for that carrier. Where devices do not clearly satisfy a given level, POIs should request advice from the Seattle AEG FSB Chairman, NSP, or AFS-200.

10.5

Door Trainers. Training in accordance with 14 CFR § 121.417 must be conducted on an aircraft or in a training device representative of the operators fleet configuration.

11. APPLICATION OF FSB REPORT

11.1

Relevant parts of this report (e.g. Type Rating Designation, checking maneuvers, etc.) are effective when the report is approved by FAA.

12. ALTERNATE MEANS OF COMPLIANCE

12.1

Approval Level and Approval Criteria. Alternate means of compliance with differences requirements of 14 CFR 121 Subpart N and O for the ERJ-170/ERJ-190, other than as specified in provisions of this report, must be approved by AFS-200. If Alternate compliance is sought, operators will be required to establish that any proposed alternate means provides an equivalent level of safety to the provisions of AC 120-53, as amended, and this FSB report. Analysis, demonstrations, proof of concept testing, differences documentation, or other evidence may be required.

12.2

Requires Equivalent Safety. In the event alternate compliance is sought, training program hour reductions, FFS approvals, and FTD approvals, may be significantly limited and reporting requirements may be increased to assure equivalent safety. FAA will generally not consider relief through alternate compliance means unless sufficient lead time has been planned by an operator to allow for any necessary testing and evaluation.

12.3

Unforeseen Circumstances. In the event of clearly unforeseen circumstances in which it is not possible for an operator to comply with MDR provisions, the operators may seek an interim equivalent program rather than a permanent alternate compliance method. Financial arrangements, schedule adjustment, and other such reasons are not considered "unforeseen circumstances" for the purposes of this provision.

13. MISCELLANEOUS - (Reserved)

APPENDIX 1

MASTER DIFFERENCES REQUIREMENTS
 (Refer to AC 120-53, as amended)

Base Aircraft ↕	Related Aircraft ↔	ERJ-170-100	ERJ-170-200	ERJ-190-100	ERJ-190-200	ERJ-190-ECJ
ERJ-170-100		N/A	A/A/A	A/A/A	A/A/A	A/A/A
ERJ-170-200		A/A/A	N/A	A/A/A	A/A/A	A/A/A
ERJ-190-100		A/A/A	A/A/A	N/A	A/A/A	A/A/A
ERJ-190-200		A/A/A	A/A/A	A/A/A	N/A	A/A/A
ERJ-190-ECJ		A/A/A	A/A/A	A/A/A	A/A/A	N/A

Note:

Installation of HGS (Head-Up Guidance System) requires additional training, checking and currency. Any ERJ-170/ERJ-190 flight crewmember who has received HGS training more than one year prior to operation of an HGS equipped ERJ-170/ERJ-190, will be required to complete HGS refresher training. HGS training is required for those flight crewmembers whose initial training was accomplished without HGS equipped training devices.

APPENDIX 2

ACCEPTABLE ODR TABLES

(Available On Request from Seattle AEG)

APPENDIX 3

ACCEPTABLE DIFFERENCES TRAINING PROGRAM

(Reserved)

APPENDIX 4

AIRCRAFT COMPLIANCE CHECKLIST

(Available On Request from Seattle AEG)

APPENDIX 5

EXAMPLE FULL TRANSITION FOOTPRINT

(Reserved)

APPENDIX 6

EXAMPLE HEAD-UP DISPLAY TRAINING PROGRAM

The HUD pilot training requirements consists of those related to initial and recurrent ground and flight training. Unless covered concurrently during an initial or transition type rating course, a prerequisite to beginning this course of training is prior training, qualification and currency in the ERJ-170/ERJ-190 airplane. It should be noted that the program focuses principally upon training events flown in the left seat by the pilot-in-command (PIC) in 14 CFR part 121 operations. Nevertheless, first officer indoctrination and training is also essential.

1. INITIAL GROUND TRAINING

For air carriers initial training should be conducted in accordance with the applicable provisions of 14 CFR §§ 121.415, 121.419, 121.424, 121.427, current revision of AC 120-28 and the air carrier operation specifications. For all air carriers, the initial ground training program should include the following elements:

1.1

Classroom instruction covering HUD operational concepts, crew duties and responsibilities and operational procedures including preflight, normal and non-normal pilot activities. For air carriers wishing credit for low visibility operations predicated on use of the HUD, information should be provided on the operational characteristics, capabilities, and limitations of the ground facilities (surface movement guidance control system) and airborne CAT III system. Air Carrier policies and procedures concerning low visibility operations should include a reporting process, MEL issues, operation following a missed approach, OE and currency requirements.

1.2

Classroom instruction (or CBT) on the HUD symbology set and it's interrelationship with airplane aerodynamics, inertial factors and environmental conditions.

1.3

A HUD pilot training manual or equivalent material in the Operations Manual which explains all modes of operation, the use of various HUD controls, clear descriptions of HUD symbology including limit conditions and failures, and incorporating a crew procedures guide clearly delineating pilot-flying (PF) and pilot monitoring (PM) duties, responsibilities and procedural call-outs and responses during all phases of flight during which HUD operations are anticipated. Emphasis on the availability and limitations of visual cues encountered on approach both before and after DH. This would include:

- Procedures for unexpected deterioration of conditions to less than minimum RVR encountered during approach, flare and rollout,
- Demonstration of expected visual references with weather at minimum conditions, and
- Expected sequence of visual cues during an approach in which visibility is at or above landing minima.

1.4

A video tape demonstrating all modes of operation complete with sound. For air carriers wishing credit for low visibility operations predicated on use of the HUD, this should include narrative descriptions and several low weather approach demonstrations with procedural call-outs and responses. All critical procedural callout possibilities should be covered.

1.5

If the HUD is used as a CAT II/CAT III landing system, emphasis on the need for rigorous crew discipline, coordination and adherence to procedural guidelines as is required for other CAT II/CAT III landing systems.

2. INITIAL FLIGHT TRAINING

Unless integrated with initial or transition type rating training, flight training dedicated to HUD familiarization and proficiency is in addition to other required elements. For 14 CFR part 121 operators, initial flight training should be conducted in accordance with the applicable provisions of 14 CFR § 121.424. Flight training dedicated to HUD familiarization and proficiency is in addition to other required elements. When a simulator is used, only FAA approved ERJ 170/190 simulators with both a visual and the Heads Up Guidance System installed may be used. For flight simulator training, all required approaches should be flown from no closer than the final approach fix (FAF) for instrument approaches and from no closer than approximately 1000 feet AGL (3 - 4 NM) to the runway threshold for visual approaches. The following flight training program is generic in nature and should not be construed to dictate what the flight course of instruction must consist of. Each operator has his own unique requirements, route structure, fleet composition, and operations policies to consider in developing their training program. Therefore, what follows might be considered as a guide to an operator who is tailoring a HUD training program to fit his own needs.

2.1

Airwork

Airwork should include:

- Straight and level flight, accelerations and decelerations,
- Normal and steep turns, climbs and descents,
- Stall prevention and unusual attitude recovery, and
- Vectors to intercept and track selected VOR courses

Note: Emphasis should be placed on HUD unique symbology, i.e., flight path, flight path acceleration, airspeed error tape, Angle of Attack limit bracket, and excessive pitch chevrons. When this training is complete, the trainee should have a thorough understanding of the relationship between aircraft flight path parameters and the HUD symbology.

2.2

Visual Approaches (VMC mode)

- Perform one approach showing deviations above and below glideslope for symbology/runway relationship,
- Straight-in landings, no wind, repeat with 10 kt cross wind and at night,
- Circling approaches and landing with 10 kt crosswind.

Note: It is desirable to fly half of these approaches at different airports that have dissimilar approach and runway lighting systems. Special emphasis should be placed on optimizing circling approach techniques and procedures. Approaches with the aircraft in a non-normal flap configuration should be included.

2.3

Instrument Approaches:

a) For all operators:

- Perform a CAT I approach to 200 foot DH, 2400 RVR, wind calm,
- Demonstrate failures and incorrect settings on approach, i.e., mis-set runway elevation, airspeed, selected course, etc.,
- Illustrate unique characteristics of symbology in wind shear conditions, i.e., erratic wind speed and direction, flight path, flight path acceleration and speed error, etc., and
- Perform a non-precision approach, VOR approach, 600-2, 15 knot crosswind.

b) For operators wishing credit for low visibility operations predicated on use of the HUD.

- Perform a CAT II approach to 100 foot DH, 1200 RVR, 5 - 10 kts crosswind,
- Perform a CAT IIIa ILS approach and landing starting on a 30 degree dogleg to final intercept to the ILS, below glideslope, weather clear and calm,
- CAT IIIa ILS with 700 RVR, wind calm - another ILS with a 10 knot crosswind,
- CAT IIIa ILS with 0/0 weather. After touchdown, raise weather to demonstrate position on runway,
- CAT IIIa ILS with various reasons for a missed approach (system downgrade, "APCH WARN", etc.),
- CAT IIIa ILS with various RVRs and crosswinds, include light turbulence.

Note: Several of the instrument approaches should include a variety of ground and airborne system failures requiring pilot recognition and appropriate procedural actions. Demonstrate system/component failures could include flap asymmetry problems, engine out operations, HGS sensor failures, etc. Demonstrate how HUD failure modes can reduce precision and increase pilot workload unless PF/PM duties and responsibilities are clearly delineated and understood.

2.4

Takeoff: For operators wishing credit for low visibility takeoff operations predicated on use of the HUD.

- Normal takeoff, clear and calm, repeated with gusty winds,
- Takeoff, 600 foot RVR, 5 knot crosswind,
- Takeoff, 300 foot RVR, 5 knot crosswind, engine failure prior to V1,
- Takeoff, 300 foot RVR, 5 knot crosswind, engine failure after V1,
- Takeoff with HGS failure, 300 foot RVR.

For airline operators; within 60 days subsequent to completion of HUD training, pilots must have completed their Operating Experience (OE) for HUD CAT II/IIIa operations. All previously qualified (in aircraft) pilots should be certified upon satisfactory completion of the HUD ground and flight training programs.

All initial, upgrade and transition captains must be certificated by a check pilot during their OE. This requirement should include three HUD assisted takeoffs: one visual approach and three instrument approaches in conditions not less than RVR 1800. First Officers should be certificated to perform Category II/IIIa PM duties upon satisfactory completion of the HUD training program.

For all operators; prior to utilizing the HUD in IMC conditions below RVR 1800, each PIC must accomplish at least twenty-five manually flown HUD approaches to Category II/IIIa minima in VMC conditions. Each approach must terminate in a manually controlled HUD assisted landing or HUD assisted go-around. In addition, each PIC must accomplish at least twenty-five HUD assisted takeoffs in VMC conditions prior to using the HUD mode in IMC conditions. Upon completion of this requirement the HUD qualified pilot would then be certificated to conduct HUD approaches to company authorized minima as set forth in their Operations Specifications.

3. RECURRENCE REQUIREMENTS

For operators wishing credit for low visibility operations on use of the HUD, during the six month recurrent training and proficiency checks, the following low visibility operations should be performed in addition to regular requirements:

- Approach and landing, 700 foot RVR, 10 knot crosswind,
- Approach, 700 foot RVR, 10 knot crosswind, light turbulence with missed app.
- Takeoff, 300 foot RVR, 10 knot crosswind,
- Takeoff, 300 foot RVR, engine failure either before or after V1.

Selected ground training subjects should be reviewed annually.

APPENDIX 7

EXAMPLE - CURRICULUM SUBJECTS
ERJ-170/190 PILOT INITIAL TRAINING

(Reserved)

APPENDIX 8

ROCKWELL COLLINS 5600 HEAD UP DISPLAY (HUD) AND KOLLSMAN FORWARD LOOKING INFRARED CAMERA ENHANCED FLIGHT VISION SYSTEM (EFVS)

1. PURPOSE AND APPLICABILITY

This appendix to the FSB report addresses the Rockwell Collins Head-Up Guidance System HGS 5600 with Kollsman Enhanced Flight Vision System (EFVS) only for the ERJ-190-100ECJ.

The operational goal of EFVS is to improve aviation safety during operations at night and in low visibility conditions due to weather or other environmental factors. Pilots using EFVS should be careful not to conclude that the flight path is free of hazards merely because none are visible in the EFVS image in the HUD. In some situations imaging sensor performance can be variable and unpredictable.

For United States registered aircraft, the AFM Supplement for this installation restricts EFVS use to qualified pilots who have been trained and current in accordance with the minimum requirements listed in this FSB report Appendix. Ground school training and simulator training is required. It is recommended that operators and training providers review AC 90-106 prior to EFVS use and training.

Even though the system is referred to as EVS in Embraer's publications, it meets the requirements for an Enhanced Flight Vision System (EFVS), as defined in the 14 CFR Part 1. Operators with the EVS system installed and following the specifications in this appendix are eligible for the credits described in § 91.175(l). Both terms are used interchangeably in this report.

2. PILOT TYPE RATING REQUIREMENTS

The pilot type rating for the Embraer 170 is "ERJ-170" and the pilot type rating for the Embraer 190 is "ERJ-190". In accordance with the provisions of the current revision of AC 120-53, the Embraer 170 and the Embraer 190 are identified as having common type ratings. The pilot type rating is unchanged for aircraft with Rockwell Collins 5600 HUD with EFVS installed.

3. MASTER COMMON REQUIREMENTS (MCR'S)

Not applicable.

4. MASTER DIFFERNCES REQUIREMENTS (MDR's)

Not applicable.

5. ACCEPTABLE OPERATOR DIFFERENCE REQUIREMENTS (ODR's)

Not applicable.

6. FSB SPECIFICATIONS FOR TRAINING

6.1 HUD

For training of the Rockwell Collins 5600 EFVS flightcrew members must be trained in accordance with Appendix 6 of this FSB report.

6.2 EFVS

The FSB recommends special training emphasis in the following areas.

The trainees must be aware that after completion of this EFVS training, a safe and efficient use of HGS and EFVS can be kept if it is used on a regular basis. It is recommended to perform HGS and EFVS operations as regularly as possible during normal operations, especially during take-off, approach, and landing phases of flight.

6.2.1 Ground School Segment.

To be qualified in either seat position in accordance with the provisions of this FSB report Appendix both pilots must attend 4 hours of ground school training meeting the specifications below. Ground school training should precede simulator training.

Infra-Red theory and associated limitations

The trainee should be made aware of the general infra-red theory and the characteristics of the EFVS image, including the dependency of the image on the weather conditions, thermal crossover (not exhaustive). In particular, the trainee should be made aware of the effect of rain (roman candles) which may degrade the EFVS image and require it to be removed.

General Description

The description of EFVS hardware is based on information from the AOM and Rockwell Collins HUD Pilot's guide and other applicable documentation (e.g. certification documentation provided by Embraer).

The information comprises of a description of the additional features to the HGS components:

- Infra-Red Sensor Unit (ISU);
- External IR Window (IRW);
- Explain the LOW and HIGH settings and the related CONTRAST/BRIGHT presets.
- Switch on the yoke (to remove the image from the HUD)
- Description, function, conditions of use.
- The modifications of the HGS to make it EFVS capable:
- HGS computer (LRU);
- HGS Over Head Unit (LRU).
- EVS controls on the combiner:
- Video brightness and contrast controls and logics;
- Symbology brightness.
- Head down EVS image (with Video feature);
- EVS annunciations in HUD
- EVS image on MCDU
- FMS / Arrival
- EVS failures (Fault messages)
- Associated circuit breakers / system protection.

6.2.3

Types of operations for which EFVS is approved – Limitations

The types of operations for which HGS with EFVS is approved and the limitations are listed in the relevant Airplane Flight Manual (AFM) supplement. Additional information can be found in the AOM and Quick Reference Handbook (QRH).

6.2.4

EFVS operating procedures

The procedures in ERJ-190-100ECJ AOM, QRH, and Standard Operating Procedures Manual (SOPM) must be used as a reference for explaining the EFVS operating procedures.

The following topics are discussed:

- General use and philosophy of EFVS operation;
- Normal procedures;
 - Calibration of the system: describe the calibration logics
 - Appropriate use of control to remove / restore the EVS image (e.g. EVS switch)
 - In addition to checking the proper operating condition, the trainee should be made aware that the use of the EVS switch before arriving to minima is useful for transition from EVS to Visual, as it improves the "see through";
 - Types of interferences that may require pilot action (calibration, removal of the image);
 - Conditions where a gain / no gain is expected, including the weather / scene image quality dependence;
 - The image brightness logic (image and symbology dependence) and associated recommendations;
 - Recommended EFVS displays (head-up / head down);

- Physical parallax of the image on ground;
- Procedures for each phase of flight from exterior inspection to after landing;
- Briefings; the criteria for deciding whether the approach is eligible or not for operational credit must be discussed in detail, e.g. discuss one eligible non-precision approach and one non-eligible non-precision approach and explain. For example, the instructor can provide the trainees with miscellaneous approach charts and ask whether those approaches are eligible.
- Crew coordination (tasks and call-outs). In particular, annunciation of published and EFVS minima and SOP's; focus on the specific callout from the PM at the EFVS Baro-minimums.
 - The trainee should be made aware of the importance of the PM call-out "EVS MINIMUM" at the EFVS minimum, because of possible delays in automatic EFVS call-outs due to prioritization of others automatic call-outs (call-out of autopilot disconnection for example).
- Where in the HUD that the PF should look to acquire required visual references for descent below published Decision Altitude (DA): the importance to look in the appropriate portion of the HUD to acquire EFVS return;
- Importance of cross checking the conformal symbology (FPV and FPA reference cues) against the EFVS visual scene presentation to enable the flight crew to recognize malfunctions of the EFVS, navigational guidance information, and improper presentation of elements in the visual scene during an approach;
- FD de-cluttering logics in the HUD;
- Identification of 100 ft HAT using Barometric Altitude for situational awareness. Response to altitude callouts and alerts;
- Non-precision approaches: deselecting of guidance panel modes after the minima when committed to land;
- AFM Performance & Obstacle Clearance on Go Around; It is the operator's responsibility to ensure that EFVS BARO M (which is at least 100 ft above the touch down zone elevation) provided to the crew and manually entered is such that airplane performances are compatible with missed approach Obstacle clearance of the approach to be performed;
- AFM Limitations and failure modes;
- Conduct of precision and non-precision (APV) approaches;
- Low Visibility Operations procedures, especially taxi procedures;
- The EFVS image can be displayed in the HUD while monitoring an automatic CAT II approach, with no EFVS operational credit.
- Weather conditions (including snow, haze, sandstorm, etc.);
 - Use relevant videos when applicable;
 - Focus on the effect of heavy rain (roman candles) which may impair the pilot's vision so that the IR image should be removed from HUD.
- Crosswind conditions;
- Abnormal procedures and limitations (Refer to AFM / AOM)
- Post flight recording and logging of the EFVS approach (according to the appropriate regulation).

6.2.5

Human Factor Aspects

Special emphasis must be set concerning human factor issues related to the use of EFVS and infrared technology, e.g.:

- Interpretation of EFVS images, especially for runway markings and lightings (including LED lighting). The trainee should be made aware about PAPI indication through the EFVS: PAPI always shows 4 green lights in HUD/EFVS image, indicating HIGH even if the aircraft is on the correct descent slope, which could make the pilot descend for the 2 RED/2 WHITE which never appears.
- Transition from EFVS imagery to non-EFVS visual conditions (maximum use should be made of videotapes of actual EFVS approaches): the relative luminosity between IR imagery and that of approach lighting systems should be identified;
 - Visual anomalies such as "roman candles", "burlap effect" as applicable (refer to AOM)
 - Use relevant videos when applicable;
 - When visual anomalies (e.g. roman candles) impair the pilot's natural vision: the pilot then must remove the EVS image from the HUD (using the EVS switch) if effect becomes too distracting.
- Misinterpretation of the IR video cues by the pilot (e.g. interpret a parallel taxiway as the active runway);
- Familiarization to IR imagery (scene contrast detected by IR sensors can be very different from that detected by natural vision; e.g. The EFVS "sees" nothing when the runway has just been cleared away from snow and the runway lights are OFF).
- Effect of combination "EFVS image / HGS symbology" in situation of non consistency of the IR image and symbology, misalignment, aircraft unusual attitude;
- Design eye position;
- Emphasize that the display of an IR image (2D image) in a HUD (narrow field of view) that may result into some "tunnelling" effects:
 - These effects may encourage to unconsciously have a deeper path angle than perceived, especially when the flight director is no longer displayed.
 - Recommendation to manage the flight path vector against the approach path reference and touchdown zone in these situation (Do not rely on the IR image to monitor or manage the A/C position and trajectory). Discuss how to use the FPV in the HUD to manage the slope on a visual approach.
 - Importance of cross checking the HGS instrumentation presentations against EFVS visual scene presentation: the pilot flying must not stop following the Flight Director unless distinctly visible and identifiable visual references are seen without reliance on the EFVS; pilots must not "follow" the EFVS image to determine the aircraft's trajectory, this image is only used to confirm the lateral alignment and touch down point.
 - Watching an EFVS image might become tiring if it is done for a long time. It should be limited only to cases where the EFVS can provide a certain benefit.

6.2.6 Applicable Regulation Requirements

Applicable regulation documents (the list should be displayed for the trainees); e.g.
FAA: 14 CFR parts 91.175, 121.651, 125.381, 135.225

6.2.7 Training progress

At the end of this instruction segment each trainee must be evaluated to determine their understanding of the EFVS.

6.2.8 Duration

The total duration of the ground session must be 4 hours.

6.3 Duration Simulator instruction segment for initial EFVS training

To be qualified in accordance with the provisions of this FSB report to serve as the Pilot Flying (PF) using the HUD with EVS, that pilot must have received 2 hours of simulator training as PF using the HUD with EVS which meets the specifications of paragraph 2.2 below.

To be qualified in accordance with the provisions of this FSB report to serve as the Pilot Monitoring (PM) during operations using the HUD with EVS, that pilot must have received 2 hours of simulator training performing the duties of the PM which meets the specifications of paragraph 2.3 below.

For both the PF and PM, these two hours must be in a level C or D simulator qualified for EFVS training, and in an EFVS training course of instruction approved under FAR 121, 135, or 142. Aircraft time may not be substituted for simulator time as the failure scenarios and various weather conditions cannot be reliably and safely replicated in the aircraft.

All the simulator exercises will be conducted from / to a runway with weather conditions compliant with each procedure. The night conditions exercises will be performed first as EFVS operations are generally easier in night conditions than in day light conditions.

The first take-off of the simulator session will be completed at maximum landing weight.

It is recommended to perform the exercises from / to an airfield with a mountainous environment in order to demonstrate the benefit of EFVS in such conditions (e.g. Innsbruck).

The simulator used for the simulator instruction segment must be FAA qualified to Level C with a daylight visual system, or to Level D. The EFVS standards must at least meet the requirements

contained in the FSTD Guidance Bulletin 03-03 Enhanced Flight Vision System (EFVS) FSTD Qualification or any other relevant regulation.

6.3.1 Briefing

EFVS procedures and limitations are reviewed. Exercises which will be performed in the simulator are discussed. The procedures in ERJ-190 AOM / QRH must be used as a reference for explaining the EFVS operating procedures detailed in § 1.4 of this appendix. The briefing will focus on the human factor issues as detailed in § 1.5 of this appendix.

Review the operational benefit as per applicable regulation and discuss how it will be introduced during this simulator session.

Review the possible differences between the simulator and the aircraft, e.g.

- The EFVS image in the HUD might be better in the simulator than it is actually in the aircraft, especially during day time, due to ambient light considerations.
- The simulator cannot reproduce some visual anomalies such as "roman candles".
- SYMB brightness setting in the HUD which may be different.

6.3.2 Simulator (left seat / PF)

6.3.2.1 Flight Preparation

- Seat positioning;
- Rudder pedal adjustment;
- Combiner adjustments (symbology brightness, contrast, ...);
- Displays, modes, annunciations;
- Design eye position;
- System use, check and test;
- Calibration

6.3.2.2 Taxi

- Taxi out from ramp or into ramp in:
- Night VMC, and
- Day low visibility conditions (100 to 150 m RVR)

6.3.2.3 Take-off

- Take-off from brakes release with 150 m RVR

- Demonstrate the use of EFVS switch on the yoke.

6.3.2.4

Multiple take-off, approaches and landings (operational benefit)

The exercises below should be performed. Repositioning the simulator between each exercise is permitted.

- Night conditions
 - After take-off (VMC) demonstrate the symbology in a clear night.
 - Precision approach - landing (VMC conditions);
 - Non precision approach / VMC conditions.
 - Demonstrate the use of FPV to manage the slope during a final approach.
 - Discuss the operational benefit of EFVS.
 - Freeze the simulator at the appropriate height during approach in order to demonstrate visual characteristics with and without EFVS for various weather conditions (if possible) and temperatures.
 - Demonstrate the benefit of EFVS in a mountainous environment (e.g. LOWI airport) and VMC conditions.
 - Demonstrate the use of EFVS kill / dim switch on the yoke.
- Day light / IMC conditions.
 - ILS CAT I precision or non-precision approaches (alternately) with ceiling below the published DH/MDA. For each exercise the visibility should be set in order to demonstrate the RVR operational benefit accordingly with the related regulation.
 - Check that the AFM limitations are observed.
 - Demonstrate operational gain through five approaches:
 - First approach (foggy conditions): the PF acquires the EFVS references at the published minima, but does not acquire the visual references at the EFVS minima: a missed approach is performed.
 - Second approach (snowy conditions + maximum offset between final approach path and runway centerline): the PF acquires the EFVS references at the published minima, then acquires the visual references at the EFVS minima and lands.
 - Third approach (foggy conditions) - IR image becomes laterally fixed and offset. The PF acquires the EFVS references at the published minima and continues. The PF should normally follow the FD guidance as per AOM procedure, and discover that the IR image is not conformal with reality: he/she should elect to go-around, or to land if visual references are acquired and a safe landing can be anticipated. Focus on the necessity to not follow the IR image.
 - Fourth approach (snowy conditions + crosswind 15kt - No offset) - Performed with AP and AT disengaged (following FD): the PF acquires the EFVS references at the published minima, then acquires the visual references at the EFVS minima and lands.

- Fifth approach: the PF acquires the EFVS references at the published minima, but loses them before acquiring natural vision on the runway (EVS FAIL Fault message): a missed approach is performed.
- Additional exercises as necessary. At least one failure impacting the EFVS operation should be performed during the simulator session (refer to AOM EVS related pages - Abnormal Procedures). One failure may result in performing the missed approach procedure with heads down.

6.3.3

Simulator (right seat / PM)

The procedures in ERJ-190-100ECJ AOM must be used as a reference concerning the crew tasks allocations, call-outs and recommended displays of EFVS image. Focus must be made on crew coordination, especially concerning the minima annunciation (unless the operator has a dedicated specific approved procedure).

The PM has to be trained accordingly.

6.3.4

Completion Standards

Successful completion of the simulator training prescribed in this appendix validates the training requirements for qualification.

6.3.5

Duration

The duration of the simulator instruction segment for EFVS initial training is 2 hours (for both the left seat (PF) and the right seat (PM)).

If both crew members have to be trained as left seat pilots for EFVS operation they will switch seats and the total duration will be 4 hours for the crew.

Note 1: Title 14 Code of Federal Regulations (CFR) Section 91.175 (c) states that a pilot may continue an approach below the authorized MDA or continue the approach below the authorized DH if subparagraphs (1), (2), and (3) are met. Subparagraph (1) states, in pertinent part, “The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made....”. Subparagraph (2) states, in pertinent part, “The flight visibility is not less than the visibility prescribed in the standard instrument approach procedures being used”. Subparagraph (3) states, in pertinent part, “...at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot...”. All three subparagraphs: (1), (2), and (3) must be met. EFVS is certified to allow the pilot to use EFVS imagery to see the visual references required by subparagraph (3). The pilot must determine flight visibility without the use of EFVS imagery.

Note 2: The EFVS is also certified for use as an aid during all phases of flight: taxi, takeoff, climb, cruise, descent, and landing.

7. FSB SPECIFICATIONS FOR CHECKING

Checking requires a proficiency check conducted in a level 'C' simulator, with a daylight visual display, in a level 'D' simulator, that has been qualified by the National Simulator Program for EFVS, or on an EFVS equipped aircraft. The proficiency check will include at least one instrument approach to published minimums and landing utilizing the EFVS. This check can be accomplished concurrently with a proficiency or competency check under 14 CFR parts 61.57, 61.58, 121.441, 135.293, or 135.297.

8. FSB SPECIFICATIONS FOR CURRENCY

If 14 CFR part 61.57 (c) is being used for currency, at least one of the six required instrument approaches must be accomplished using EFVS to published minimums. These approaches need not be performed in actual night/fog/snow conditions.

Principal Operations Inspectors should include at least one takeoff, approach, and transition to landing when approving a training program meeting CFR 14 part 121.427(d).

9. FSB SPECIFICATIONS FOR FTDs OR FFS

FTD and FFS characteristics are designated in 14 CFR Part 60 and FSTD Guidance Bulletins 03-02 and 03-03 (as amended). The acceptability of differences between FTDs, FFS, and aircraft must be addressed by the POI or TCPM.

Requests for approval should be made to the POI or TCPM.

10. ALTERNATE MEANS OF COMPLIANCE

The FSB chairman should be consulted by the POI or TCPM when alternate means of compliance, other than those specified in this appendix, are proposed. Alternate means of compliance must be approved by the FAA Air Transportation Division, AFS-200. If an alternate means of compliance is sought, operators will be required to submit a proposed alternate means for approval that provides an equivalent level of safety to the provisions of AC 120-53B and this FSB report Appendix. Analysis, demonstrations, proof of concept testing, differences documentation, and/or other evidence may be required.

In the event that alternate compliance is sought, training program hour reductions, FFS approvals, and FTD approvals may be significantly limited and reporting requirements may be increased to ensure an equivalent level of training, checking, and currency. FAA will generally not consider relief through alternate compliance means unless sufficient lead-time has been planned by an operator to allow for any necessary testing and evaluation.