EUROPEAN AVIATION SAFETY AGENCY

Operational Evaluation Board Report

Dassault Aviation F2000EX

Revision 4

29 June 2012

European Aviation Safety Agency
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Contents

Dassault Aviation Falcon 2000EX

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Revision Record

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Dassault Falcon 2000EX OEB Team Composition

Name	Capacity	Task
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1) Initial JAA Evaluation
2) Steep Approach Landing

Note on references and reference texts:
Where references are made to requirements and where extracts of reference texts are provided, these are at the amendment state at the date of publication of the report. Readers should take note that it is impractical to update these references to take account of subsequent amendments to the source documents.

Acronyms

AC ..... Advisory Circular

AFM ..... Airplane Flight Manual

AFCS ..... Automatic Flight Control System

AP ..... Autopilot

AT ..... Auto throttle

CCD ..... Cursor Control Device

CPD ..... Common Procedures Document for conducting Operational Evaluation Boards, dated 10 June 2004

DC ..... Display Controller

EDM ..... Emergency Descent Manoeuvre

EFIS ..... Electronic Flight Instrument System

EICAS ..... Engine Indicating and Crew Alerting System

EVS ..... Enhanced Vision System

EU-OPS ..... Commission Regulation (EC) No 859/2008 of 20 August 2008 amending Council Regulation (EEC) No 3922/91 as regards common technical requirements and administrative procedures applicable to commercial transportation by aeroplane.

FAA ..... Federal Aviation Administration

FGS ..... Flight Guidance System

FMS ..... Flight Management System

FSB ..... Flight Standardization Board

FTD ..... Flight Training Device

GPWS ..... Ground Proximity Warning System

HUD ..... Head Up Guidance Display

I-NAV ..... Integrated Navigation Display

IRS ..... Inertial Reference System

JAA ..... Joint Aviation Authority

MCDU ..... Multi-Function Control Display Units

ND ..... Navigation Display

PFD ..... Primary Flight Display

RFMU ..... Radio Frequency Management Unit

TCAS ..... Traffic Alert and Collision Avoidance System

TRTO ..... Type Rating Training Organisation

VGS ..... Visual Guidance System

VNAV ..... Vertical Navigation

WOW ..... Weight on Wheels

Executive Summary

An initial Operational Evaluation was performed by an integrated team composed of FAA and JAA members. Subsequently EASA performed an operational evaluation of the steep approach procedure.

These evaluations were performed in compliance with the applicable Terms of Reference, corresponding complementary procedures, the JOEB/OEB Handbook and the CPD.

This report specifies the EASA recommendation of minimum requirements for the type rating training course, checking and currency on the Dassault Falcon 2000EX, as specified in JAR-FCL 1 and EU-OPS.

This report also contains the findings of the operational suitability of the Dassault Falcon 2000EX with regards to EU-OPS.

The OEB recommends the approval of the Dassault Aviation proposed training course for type rating on the Dassault Falcon 2000EX.

The OEB recommends the licence endorsement "**Falcon 2000/2000EX"**. Recommendations linked to the pilot type rating are described in paragraph 2.0 Pilot Type Rating Requirements.

Captain Herbert Meyer
Section Manager, Operational Suitability - Fixed Wing -
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Operational Evaluation Report / FCL & OPS Subgroup

1. Purpose and Applicability

This report:

- Defines the type rating assigned to the Falcon 2000EX aircraft
- Proposes Master Common Requirements – MCR tables
- Describes Master Difference Requirements – MDR tables, for crews requiring differences training
- Line Flying Under Supervision (LIFUS)
- Provides reference of acceptable Operator Difference Requirements (ODR tables)
- Recommends the Differences (Transition) Training course
- Recommends Checking
- Recommends Currency

1.1 Overview

The Falcon 2000EX is a variant of the Falcon 2000. Major changes to the Falcon 2000EX are the FMS Collins 6100 (not optional), addition of two fuel tanks (forward and rear), addition of two fuel boosters pumps, addition of automatic airbrakes function, modification in the bleed air system and control, a strength in the landing gear, an electric main cabin door entrance (basic feature on the 2000EX) and a change of engines (P&W 308C) increased engine thrust and a 4800 lbs increase in maximum ramp and takeoff mass.

1.2 General Information on the Flight

This is a summary of the T2 test on the Falcon 2000EX:

Aircraft	Falcon 2000EX		
Registration	F-WMEX		
Serial Number	s/n 001		
Place	Istres, France		
Block Times	Off Blocks	12 36	16 42
	On Blocks	13 52	17 55
Crew	The flights were under the command of Dominique CHENEVIER (Dassault test pilot), who occupied the right hand seat.		
	Xavier Barral (JAA Pilot)		
	Ken Gendron (FAA Pilot)		
	Poul Jensen (JAA Pilot)		

2. Pilot Type Rating Requirements

In reference to JAR FCL1 Subpart F JAR-FCL 1.220 and to the JOEB Evaluation process, the same type rating and, consequently the same licence endorsement "**Falcon 2000/2000EX**" is assigned to the Falcon 2000 and the Falcon 2000EX.

Dassault Aviation has produced ODR tables specifying the differences training from the Falcon 2000 to the Falcon 2000 EX.

3. Master Common Requirements (MCR) – JAA

3.1 Minimum Height for use of the Autopilot:

The minimum height for use of the autopilot after takeoff is 1000 feet AGL and 70 feet AGL during approach in either aircraft.

3.2 Normal 'Final' Landing Flap Setting:

The normal 'final' landing flap position is the same on both aircrafts

3.3 Flight Control System (AFCS):

The AFCS pilot/machine interface is the same for both aircrafts

3.4 Procedure Knowledge:

The climb and descent profiles is the same for both aircrafts.

3.5 Aircraft approach and circling categories:

The following aircraft categories, (based on maximum landing weight – MLW and 1.3 Vso) for the Falcon 2000 and Falcon 2000EX, are as follows:

Aircraft	Landing Flap	Category
Falcon 2000	40 degrees	C
Falcon 2000EX	40 degrees	C

3.6 Approach Profiles and Speeds:

The approach profiles are the same for the Falcon 2000 and the Falcon 2000EX approach speeds are dependent upon aircraft weight. Although the Falcon 2000EX operates at a heavier maximum take-off weight, the maximum landing weight is changed and is 2800 lbs over of the maximum takeoff weight of the Falcon 2000. However the increase in the approach speed for the 2000EX is not significant. All critical speeds are automatically presented to the pilot in a standardised manner for both aircrafts.

3.7 Abnormal and Emergency Procedures:

Checked for consistency.

4. Master Difference Requirements (MDR) – JAA

Master Difference Requirements (MDR) for the Falcon 2000EX are shown here below

Master Differences Requirements (MDR) Table			
		From Aircraft	
		F2000	F2000EX
To Aircraft	F2000EX	C/B/B	Not applicable
	F2000	Not applicable	Not applicable

Falcon 2000EX to Falcon 2000 has not been evaluated. Dassault Aviation does not envisage to request that evaluation.

5. Line Flying Under Supervision – LIFUS/Base Training

There are a variety of reasons why the JOEB may specify 'Line Flying Under Supervision' in conjunction with master difference requirements. One or more of the reasons described below may apply:

- Introduction of a new aircraft type
- Introduction of new systems
- Introduction of new operations e.g. oceanic operations
- Experience for a particular crew position e.g. PIC & SIC
- Post qualification skill refinement e.g. refining ways of operating efficiency, flexibility and/or convenience
- Special characteristics e.g. high altitude airport operations, air traffic control procedures and non standard airfield operations

This LIFUS requirement is intended to permit pilots to obtain additional operating experience in order to become fully cognizant with the differences in each aircraft.

A. For JAR-OPS 1 Operators :

- Initial training for Falcon 2000EX:
- Due to the fact pilots have to be trained on a FFS of Falcon 2000 and have to follow a differences training course, a minimum of 10 sectors plus a line check should be recommended for line under supervision.
- For pilots already type rated on Falcon 2000 and current on that type, the 10 sectors may be reduced to a minimum of 4 sectors (2 of them have to be long haul operations) plus line check.

B. For non-JAR-OPS 1 Operators:

During the transition period waiting for implementation of JAR-OPS 2, and Operators working under corporate or aerial work, LIFUS is not a requirement, so JOEB recommends after completion of the differences training course, that pilots follow a base training flight (non revenue flight)

This flight would not be less than 45mn for one pilot under the supervision of a TRI from an approved TRTO.

The syllabus of that flight is:

- Flight preparation with the use of the FMS.
- Climb to FL200 (or more); use of pressurization in manual mode.
- Use of fuel overhead panel.
- Back to an adequate field: standard circuit with touch and go followed by a simulated engine failure after lift-off and a one -engine standard circuit with a go-around in final, reduced circuit.
- ILS or VOR/DME approach
- Full-stop landing

6. Acceptable 'Operator Difference Requirements' (ODR) – JAA

Acceptable Operator Difference Requirements tables for operators, operating both the Falcon 2000 and the Falcon 2000EX are shown in Appendix 1.

These ODR tables represent an acceptable means of compliance with MDR provisions for the aircraft evaluated based on those differences and compliance methods shown. These tables do not necessarily represent the only means of compliance for operators.

The ODR tables shown in Appendix 1 have been found acceptable by JAA.

7. Initial Training Course – Type Rating Course

Due to the fact no FFS is available the Falcon 2000EX Type Rating Course is composed of the initial Falcon 2000 Type Rating Course followed by Differences Training Course developed in the paragraph 8.0.

8. Differences Training Course

The Falcon 2000EX training course is in compliance with the AMC 1.261(c)(2) of JAR-FCL1 (A) Subpart F as shown in Appendix 2.

8.1 For non-JAR-OPS 1 Operators, the Course is divided in the following phases:

- Ground Phase
- Written /computer based examination (Appendix 1 to JAR-FCL 1-261(a)) - base training flight (see §5-0)

8.2 For JAR-OPS 1 Operators, the Course is divided in the following phases :

- Ground phase
- Written /computer based examination (Appendix 1 to JAR-FCL 1-261(a))
- LIFUS

Ground phase:

Two working days (11 hours) with 4 hours added for pilots not current on Collins FMS 6100. See appendix 2.

9. Checking

Proficiency checks must be conducted in accordance with JAR-FCL 1.245 'Type and class ratings – Validity, revalidation and renewal' and JAR-OPS 1.965 'Recurrent training and checking'.

The JAA JOEB, as well as the FAA confirmed that a proficiency check conducted on one variant is valid for all, provided that the differences have been covered during recurrent training, as per Appendix 2.

10. Currency

Compliance with JAR-OPS 1.970 'Recent experience' or JAR-FCL 1.026 'Recent experience for pilots not operating in accordance with JAR-OPS 1' as appropriate is required for recent experience.

The JOEB concluded that take-offs and landings performed on either the Falcon 2000EX or the Falcon 2000 are valid for each variant.

11. Cabin Crew Requirements

The JOEB has yet to evaluate this requirement if needed.

12. Head Up Display – HUD

The Head-up Display System installed on the Falcon 2000EX is exactly the same installed on the Falcon 2000 and has the same purposes (CAT III manual capability).

Therefore the Falcon 2000 HUD Guideline for gaining CAT III operational approval is valid for Falcon 2000 EX HUD operation.

13. Enhanced Vision System – EVS

For the time being such a system is not proposed on this type of aircraft.

14. Steep Approach Landing

14.1 General Description of the Steep Approach

14.1.1 A Steep Approach is used primarily when there are obstacles in the approach path that are too high to allow a normal °3 approach path. An approach path angle of 4,5 degrees or more is considered a steep approach.

14.1.2 The EASA OEB has determined that the conduct of steep approach landing operations requires no higher piloting skill level that than of normal 3° approaches However, since steep approach landing operations are often tailored to demanding airports - located in mountainous areas, having short runways - the EASA OEB requires flight training, including briefing (no formal

academic training, i.e. no classroom training), for competency in conducting steep approach landing operations.

14.1.3 The EASA OEB found that Falcon 2000EX is operationally suitable for steep approach landing operations up to an approach path angle of 6.65 degrees with aircrew trained in accordance with the requirements set in this paragraph, and using associated CODDE2 procedures provided by Dassault Aviation.

14.2 The Operational Suitability Evaluation process

An Operational Suitability Evaluation of Falcon 2000EX Steep Approach, using a Falcon 2000 (same avionics) and Falcon 2000EX EASy (same engines) full flight simulators was performed by EASA OEB respectively on 28 October 2011 and 26 October 2011. No flight testing in the aeroplane was deemed necessary by the EASA OEB.

14.3 EU-OPS Requirements for Steep Approach Procedures

The following EU-OPS and associated AMC references relate to steep approaches:

- Appendix 1 to OPS1.515(a)3: Steep approach procedures
- EU-OPS1.975: Route and aerodrome competence qualification
- AMC OPS1.975 §5 (TGL44): Route and aerodrome competence qualification (Category C aerodrome)

14.4 Falcon 2000EX References

Refer to appropriate CODDE2 and AFM Annexes.

14.5 Steep Approach Aerodrome Requirements

Operators must comply with any aerodrome specific requirements for steep approaches (e.g. in London City - EGLC).

Note: Pilots performing steep approaches at Lugano airport (LSZA) must be informed about the Dassault letter titled "Falcon - Lettre de non-objection pour les approches de Lugano" (Reference DGT-DTC/CER 568463 dated 22 June 2006). This letter specifies that Dassault has no objection regarding the initial phase of the approach flown at 6.65º provided that the aircraft is operated in accordance with the AFM or the associated operating manual, and that the operator has obtained operational approval from the competent Authority.

14.6 Specifications for Training

14.6.1 Pilot Training Prerequisite

No prerequisite is required before entering the Steep Approach pilot course except a current type rating on the aeroplane, or a full initial type rating training up to, but excluding, the check ride.

14.6.2 The crew must be trained in using the procedure provided in the Dassault Aviation CODDE2 Operating Manual (Normal Operations - Special Procedures - Operations) or in the equivalent company SOP's.

The Steep Approach pilot training course can be included as an integral part of the aeroplane type rating training course.

14.6.3 Steep Approach Pilot Training Programme

14.6.3.1 Flight Training

Flight training (as PF or PNF) may be conducted in a Falcon 2000EX (or Falcon 2000 or Falcon 2000EX EASy) Level C or D FFS or in the aircraft with a Type Rating Instructor (TRI) and must address the following:

- Briefing prior to the simulator session, or during the flight preparation to include: AFM/CODDE2 Limitations, Normal / Abnormal Procedures, Performance with special emphasis on increased landing distance.
- Phases of the Steep Approach, to include: Stabilized approach concept as a key success for steep approach landing, appropriate slats / flaps configuration, approach speed, and flare initiation.

14.6.3.2 Initial Training

The initial training should comprise, as a minimum, three Steep Approaches:

- one approach following a 5.5° Approach Path Angle with full stop landing to comply with normal procedures; and
- one approach following a 6.65° Approach Path Angle with engine anti-ice management introducing an abuse in speed, managed by crew using AB1 and AB2 alternatively (pilot has to demonstrate his ability to be stabilized at 1000 ft), until touchdown followed by a go-around; and
- one approach following a 5.5° or 6.65° Approach Path Angle with an engine failure below 400 ft, followed by a full stop landing or a go-around at pilot discretion.

When a HUD is installed, the OEB recommends to perform the first approach using the HUD (final phase is VMC), and in accordance with the CODDE2/AFM Limitations section applicable for steep approaches. In flight, the OEB recommends HUD use during the VMC phase.

14.6.3.3 Recurrent Training

The Recurrent Steep Approach training should be performed every 6 months, and should include, as a minimum, one Steep Approach and a second Steep Approach where non-normal situations are introduced during the Approach.

14.6.3.4 Training Areas of Special Emphasis

The approach briefing should include all aspects of the Steep Approach, including as a minimum:

- normal and abnormal procedures during the Steep Approach;
- transition from a glide path reference system to a visual glide path indicating system; and
- computation of the field length data when using steep approach criteria.

The crew should become proficient on the task sharing described in the Special Procedure for Steep Approach, in particular regarding go-around. Both pilots shall be trained in the procedure as PF and PNF, as applicable.

14.7 Recent Experience / Currency

The OEB determined that there is no specific recent experience or currency requirement for Steep Approaches.

14.8 Training credit

Training credit (Initial and Recurrent) can be given for Steep Approaches training performed on either Mystère-Falcon 900, Falcon 900C, Falcon 900EX, or Falcon 2000, provided a briefing covering the steep approach procedures avionics differences is taken.

14.9 Period of Validity of Competence

Before performing Steep Approach Landing Operations, an operator shall ensure that the pilot in command fulfills the same requirements of EU-OPS1.975(b)(c) and (d).

14.10 Checking Requirements

There is no requirement for knowledge checking or flight proficiency testing for Falcon 2000EX steep approach qualification.

Proof of completion of Falcon 2000EX, Falcon 2000, Mystère-Falcon 900, Falcon 900C, or Falcon 900EX steep approach training is sufficient to demonstrate qualification.