EUROPEAN AVIATION SAFETY AGENCY

Operational Evaluation Board Report

Gulfstream / GALP G280
Report of the FCL/OPS Subgroup

13 February 2013

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Gulfstream / GALP G280

Operational Evaluation Board (OEB)

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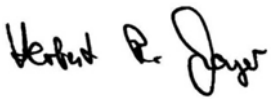

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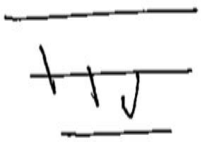

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Revision Record

Rev. No.	Content	Date
Original	G280 Initial Evaluation	12 Feb 2013
Corr. 1	Editorial correction in para. 3.1.4.2	13 Feb 2013

Contents

Acronyms

AC .....Advisory Circular

AFM.....Airplane Flight Manual

CBT .....Computer Based Training

CCD.....Cursor Control Device

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

CRM .....Crew Resource Management

DCP.....Display Control Panel

Difference Level .....a designated level of difference as defined in the CPD for the evaluation of pilot training, checking, and currency

DSP.....Display Select Panel

DU .....Display Unit

EASA.....European Aviation Safety Agency

EFB.....Electronic Flight Bag

EFIS.....Electronic Flight Instrument System

EGPWS .....Enhanced Ground Proximity Warning 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

FCL.....Flight Crew Licensing

FFS .....Full Flight Simulator (Level C or D)

FMS.....Flight Management System

FSB.....Flight Standardization Board

GALP.....Gulfstream Aerospace Limited Partnership

GPWS.....Ground Proximity Warning System

HUD.....Head Up Guidance Display

ISI .....Integrated Standby Instrument

JAA.....Joint Aviation Authorities

JAR.....Joint Aviation Requirements

LIFUS .....Line Flying Under Supervision

LNAV .....Lateral Navigation

LPC.....Licence Proficiency check

LST .....License Skill Test

MCDU.....Multifunction Control Display Unit

MFD .....Multi-Function Display

MMEL .....Master Minimum Equipment List

NAA .....National Aviation Authority

ND .....Navigation Display

OEB.....Operational Evaluation Board

OSD .....Operational Suitability Data

Part-FCL.....Annex I to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

PF .....Pilot Flying

PFD .....Primary Flight Display

PIC .....Pilot In Command

PM .....Pilot Monitoring

PTH .....Pilot Training Handbook

QRH.....Quick Reference Handbook

RNAV .....Area Navigation

RNP .....Required Navigation Performance

SIC .....Second In Command

SMC.....Standby Multifunction Controller

SOP.....Standard Operating Procedure

SVS .....Synthetic Vision System

TASE .....Training Areas of Special Emphasis

TAWS.....Terrain Awareness and Warning System

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

TCM.....Thrust Compensation Module

VNAV.....Vertical Navigation

WAI.....Wing Anti Ice

Terminology

Base aircraft means an aircraft or group of aircraft used as a reference to compare differences with another aircraft.

Currency means the experience necessary for the safe operation of aircraft, equipment and systems.

Recent experience means the recent experience described in Part-FCL and EU-OPS.

Difference level means a designated level of difference as defined in the CPD, between a base and a candidate aircraft, for the evaluation of pilot training, checking, and currency.

Preamble

1. Introduction

An operational evaluation for the Gulfstream G280 aircraft was conducted by a partially joint EASA OEB and FAA FSB team in Savannah, GA and Dallas, TX between March and December 2012. Each Authority uses the results of the evaluation process to produce a report specific to its particular requirements that, while similar in intent, may differ somewhat in detail. This OEB report is applicable to operations under the framework of EASA.

The EASA Operational Evaluation was conducted in accordance with the EASA OEB Handbook, the CPD, and applicable Part-FCL and EU-OPS requirements.

Determinations made in this report are based on the evaluations of a G280 production equivalent aircraft equipped in a given configuration and in accordance with current regulations and guidance. Modifications and differences made to the model described herein, or introduction of other variants may require amendment of the contents of this report.

2. Scope

This report contains recommendations for:

- pilot licence endorsement for the Gulfstream G280;
- initial pilot type rating training, including in-aircraft and Full Flight Simulator flight training on the G280;
- pilot training, checking, and currency / recent experience.

This report does not address the Master Minimum Equipment List (MMEL), Cabin Crew Training, Maintenance Training, Simulator Qualifications, special operations or the use of special equipment or functions such as Electronic Flight Bag (EFB), Synthetic Vision Systems (SVS), RNP (AR) operations, Steep Approaches, ETOPS, wake vortex categorization, etc.

All EASA OEB reports are available at http://www.easa.europa.eu/certification/experts/flight.php

OEB G280 FCL/OPS Subgroup Composition

Name	Organization	Function
José Gil Crespi	EASA	EASA Team Member
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Jaap Meijer	EASA	EASA Team Leader
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Steve L. Ford	FAA	FSB Chairman
Mike Nash	FAA	FSB Team Member
Jay Stiles	FAA	FSB Team Member

Note on references and reference texts:
Where references are made to requirements and where extracts of reference texts are provided, these are normally applicable at the time of the particular evaluation. Readers should take note that it is impractical to update these references to take account of subsequent amendments to the source documents.

Operational Suitability Data Report – FCL/OPS Subgroup

1. Pilot License Endorsement

EASA recommends that a new license endorsement "**G280**" is applied for the Gulfstream G280 series aircraft as shown in the following table:

1 Manufacturer	2 Aeroplanes		3	4 Licence Endorsement
Gulfstream Aerospace LP (GALP)	Gulfstream G150	G150		G150
	Gulfstream G200	G200		G200
	Gulfstream G280	**G280**		**G280**

2. Aircraft Specifics

2.1 Customization of Procedures and Checklists

The OEB evaluated standard Gulfstream procedures and checklists. Any customization should be evaluated by the Competent Authority.

The manufacturer has developed procedures to be followed in case of abnormal and emergency situations. It is the manufacturer's philosophy to not identify any steps in these procedures as so-called "Memory Items". Yet pilots are expected to perform some of those initial and critical steps without reference to any documentation. Emergency procedures are an essential part of the training curriculum. The OEB recommends operators to establish, as part of their SOP's, which steps of these procedures should be initially performed immediately and without reference to a checklist. Pilots, who are to operate this aircraft without the background of an established operator, should be provided adequate guidance at the earliest possible time during their training.

It is further recommended to include noise abatement procedures in SOP's as these are common at many European airports.

2.2 Aircraft Approach Category

With reference to EU-OPS Appendix 2 to 1.430(c) the approach category for the G280 is as follows:

Aircraft	Category
G-280	C

In accordance with EU-OPS this category is valid for all approaches.

2.3 Forward Observer Seat

The G280 forward observer seat is part of the type certificated design. The OEB evaluated it and found that it is operationally suitable.

2.4 Standby Multifunction Controller (SMC)

The Standby Multifunction Controller (SMC) comprises a Display Select Panel (DSP) and Display Control Panel (DCP). When not being used for flight or system management purposes, the DCP displays the Integrated Standby Instrument (ISI). The ISI provides flight and navigation information to the pilot.

Two SMCs are located on the glare shield, one in front of each pilot. The SMC combines the ISI and a menu control system for other system displays and selections. The crew may manually select the ISI for display on either SMC.
In addition, the following conditions will result in the automatic display of the ISI, without additional crew action:

- Loss or Reversion of a PFD
- Electrical Break Power Transfer (in-flight only)
- PFD to MFD conversion after loss of two DU's
- Cross-side SMC failure
- Attitude Miscompare (PFD-to-PFD or PFD-to-ISI or ISI-to-ISI)
- Altitude Miscompare (PFD-to-PFD or PFD-to-ISI or ISI- to-ISI)
- Heading Miscompare (PFD-to-PFD or PFD-to-ISI)
- Airspeed Miscompare (PFD-to-PFD or PFD-to-ISI)
- Unusual Pitch Attitudes and Bank Angles

The EASA AFM does not address manual selection of the ISI during any phases of flight. However, operators should consider any conditions or operational procedures for the flight crew to have one ISI displayed during the takeoff and approach/landing phases of flight when determining their own operational procedures.

2.5 Compliance Checklist EU-OPS Subparts K and L

A compliance evaluation with EU-OPS Subparts K and L was performed on a production aircraft at the Gulfstream Completion Center at Dallas-Love Field. This particular airplane was found to be either compliant, or to be equipped in excess of what is required by the Regulation. Production aircraft are often outfitted by specialist companies and NAAs are recommended to ensure individual aircraft are compliant with these requirements.

3. Specifications for Pilot Training

3.1 G280 Initial Type Rating Course

The OEB evaluated the Gulfstream G280 Type Rating training course for initial pilot type rating and found it to be compliant with Part-FCL. The OEB developed a recommendation for a G280 type rating training course, based on the results of this evaluation.

3.1.1 Prerequisites

These provisions apply for pilots who meet the minimum prerequisites in accordance with Part-FCL FCL.720.A.

The G280 is a high performance turbojet aircraft. Its operation is centred on a complex integrated avionics system, including EFIS displays, FMS and automated Flight Guidance and Control systems. Furthermore, the aircraft has advanced warning systems, including TCAS and TAWS. A pilot who meets the minimum prerequisites of Part-FCL as described above, should be considered unfamiliar with these features. Credits may be given to pilots who have experience in multi-engine turbojet aircraft, EFIS, and FMS.

3.1.2 Theoretical Knowledge

The theoretical knowledge curriculum should be the same for pilot-in-command or co-pilot training, and regardless of whether the practical training is performed in an FFS or the aircraft.

Theoretical knowledge training and checking must provide for adequate knowledge and understanding of the aircraft systems and, in addition, should ensure satisfactory knowledge and understanding of outfitted systems common to other aircraft of equivalent complexity and performance. It must not be assumed that pilots undertaking G280 type rating training have a working knowledge and understanding of systems such as FMS, EFIS selection and displays, Automated Flight Guidance and Control Systems, TAWS, TCAS, etc.

When agreed by the Competent Authority, pilots with relevant knowledge and/or previous experience may benefit from credits towards a reduction of the ground school curriculum. For those pilots a “core” curriculum, consisting of a minimum of 58 hrs. classroom instruction, enhanced by an additional 10 hrs. System Integration Training in an approved Training Device is recommended.

For pilots with limited or no experience with any or all of the systems mentioned above, the Board recommends additional modular training, as appropriate, before entering the G280 Ground School training phase.

The Board further found that for training efficiency the following should be available:

- a consolidated Pilot Training Handbook to contain all relevant documentation required for training and self-study;

- part-task and desk top trainers to support the classroom lessons by hands-on practice;

The instruction of complex systems should focus on the essential details required for the safe operation of the aircraft.

3.1.3 Flight Training in Aircraft

3.1.3.1 General

For type rating training and checking, full use of an approved Full Flight Simulator is considered the standard. Flight training in aircraft is considered an exception and should only be approved in unforeseen situations where an approved FFS is not available, as defined with the Competent Authority.

3.1.3.2 Prerequisites

Flight training in aircraft has its limitations with respect to the level and to the extent to which more complex emergency/abnormal situations can be practised and checked. Therefore, the OEB recommends that flight training in aircraft

- should be limited to trainees with previous experience on an equivalent type or category of aircraft; and
- should be by followed by specific emergency procedure training in an FFS during recurrent type rating training within one year

3.1.3.3 G280 Type Rating training (flight training in aircraft)

Taking into account the prerequisite requirements in paragraphs 3.1.1 and 3.1.3.2 of this report, and based on the observations during the evaluation, the OEB recommends a minimum of 6 training flights of 2 hrs. each, followed by a Type Rating Skill Test in accordance with Part-FCL Appendix 9.

3.1.4 Flight Training in FFS

3.1.4.1 General

Use of an approved Full Flight Simulator is considered the standard for G280 flight training. Flight Simulator training offers excellent opportunities to use both skill training, where a number of manoeuvres may be performed in a less time consuming sequence, as well as LOFT which is based on a realistic time-line. It also allows a controlled, gradual increase in complexity of scenarios and the selection of a variety of conditions. It is recommended to use these features to their fullest extend to optimize training.

3.1.4.2 G280 Type Rating training (flight training in FFS)

Taking into account the considerations in paragraphs 3.1.1 and 3.1.2, and based on the observations during the evaluation, the OEB recommends a minimum of 6 FFS training sessions, operating as a crew, of 4 hrs. each, followed by a Type Rating Skill Test in accordance with Part-FCL Appendix 9. This is to be considered the minimum "core" course for suitably qualified and experienced pilots. For pilots without relevant experience, the OEB recommends additional modular simulator training as appropriate before starting the core course.

Note: Systems Integration Training, in addition to this minimum of 6 x 4 hrs (i.e. 24 hrs), is covered separately in paragraph 3.1.2 Theoretical Knowledge.

3.2 Seat-dependent tasks training

The OEB identified the following seat dependent tasks for the G280 training:

- Passenger Oxygen System activation (right seat)
- Nose wheel steering through the tiller (left seat)

3.3 Training Areas of Special Emphasis (TASE)

The following items should receive special emphasis as specified, during ground and flight training in all referenced training courses:

- **Noise Abatement Procedures (as applicable)**
  Training should include the use of Standard Noise Abatement procedures, where these exist.
- **Weight and Balance and Performance Planning**
  Weight & Balance and performance data are widely dispersed within the AFM. Emphasized instruction is needed to reinforce the location and application of tables, charts, and graphs, in determining weight and balance and aircraft performance.
- **Display Select Panel / Display Control Panel / CCD operation and interaction**
  Many of the menus, displays, and navigation functions are controlled through the DSP/DCP as well as through the CCD. The various methods of accessing menus, selecting and configuring displays, inputting and retrieving data, operating various sub-systems and managing graphical flight planning must be emphasized and practiced regularly in training, such that crewmembers are thoroughly familiar with their function and capabilities.
- **Flap setting verification at takeoff**
  It is imperative that pilots have detailed knowledge of the specific characteristics of the G280 Take-Off Warning System. The system warns the pilots of flap settings outside the approved take-off range (greater than 22º) as power is applied on takeoff. There is no

aural or visual warning if the flaps are set incorrectly at a position less than 22º. Performance calculations and related flap settings in the FMS are not linked with the actual flap position. However, the difference in Take-Off reference speeds within the Take-Off range of flap settings is large. A potential catastrophic situation may occur if flaps are left at 0 degrees, while speeds are calculated for flaps 20, which is the normal T/O flap setting. CRM training must emphasize that, before take-off, a correct flap setting, in accordance with the calculated take off performance, is selected and indicated and verified by both pilots.

- **Flight Control Modes, Stall Warning and Stall Protection System**

  It is important to thoroughly and completely understand the operation of the aircraft in each of the lateral and vertical flight control modes and, where applicable, thrust control modes.

- **Instrument Approaches**

  The PlaneView280 avionics package (based on Rockwell Collins Proline Fusion) enables a wide array of instrument approaches to be flown, using both conventional ground-based and space-based aids to navigation (with or without augmentation). Approaches may be based on different kinds of lateral and vertical guidance, each with its own characteristics, minimums and displays and selections. For a safe operation, thorough understanding of each type of approach, its limitations and correct selection of Flight Modes is essential.

- **No-flap approach and landing**

  In a situation where the flaps are failed in the 0° position, the approach and landing speeds are sufficiently close to other limiting speeds, such as tire limit speeds and landing gear operating speed, to warrant special emphasis of these limiting factors during training scenarios for this situation.

- **Emergency descent procedure**

  The G280 has a unique capability to automatically start an Emergency Descent profile in the event of a loss of cabin pressure above 34,000 feet.

- **Integrated standby Instrument/Display (ISI)**

  The ISI display should be trained during normal and non-normal operations, both in manual selection and following automatic “pop up” display, including in startle scenarios and various phases of flight.

- **Thrust Compensation Module (TCM)**

  Training will include engine failure on takeoff after V1 with the TCM activated. This is to ensure that pilots experience the amount of manual rudder control necessary to maintain aircraft directional control, without over controlling, on takeoff.

- **Auto Brakes**

  Pilots must be thoroughly familiar with the Auto Brake system functionalities. Both for take-off (minimum balanced field length) and for landing (minimum required/actual landing field length), the performance data are based on the proper setting and use of the airplane's brake system. It is especially important to emphasize that for landing distance calculations, full manual braking will give the shortest landing distance, while the 3 Auto Brake settings generate a fixed deceleration during the landing roll. With Auto Brakes selected, brake application may vary as other deceleration factors (headwind, thrust reverse) vary.

- **Bank Angle**

  The bank angle of the G280, specifically on take-off rotation and during touchdown has to be limited to avoid the wingtip making ground contact. This requires special attention during take-offs and landings in crosswind conditions, as well as during situations of asymmetric thrust.

Operators may add additional elements as required by their operation, and these will vary. Training organisations should review their training courses when applicable aircraft modifications occur. Training organisations may add additional elements as required by the operator.

3.4 Special Events Training

Special events training to improve basic crew understanding and confidence regarding aircraft handling qualities, options and procedures as these relate to design characteristics and limitations may include the following:

- recovery from unusual attitudes;
- manual flight with minimum use of automation, including flight under degraded levels of automation;
- handling qualities and procedures during recovery from an upset condition (e.g., wake vortex encounter, loss of control incident);
- high altitude high and low speed buffet margins and flight characteristics;
- Wind shear and predictive wind shear escape manoeuvres, as applicable;
- Controlled Flight Into Terrain (CFIT), TCAS, EGPWS (emphasis on avoidance and escape manoeuvres, altitude awareness, TCAS / EGPWS warnings, situational awareness and crew co-ordination, as appropriate).

4. Recurrent Training

Recurrent training must be compliant with Part-FCL and EU-OPS as applicable, and include the Training Areas of Special Emphasis as identified in this report.

Recurrent training should incorporate special events training as described in this report on a rotational basis.

5. Specifications for Checking

Checking must be conducted in accordance with Part-FCL and EU-OPS as applicable. The OEB recommends that the following items should be included in the skill test and proficiency check schedules:

- GNSS approaches (LPV and/or LNAV/VNAV or LVAV/Baro); and
- a No-Flap or Non-Standard Flap Approach

6. Specifications for Recent Experience and Currency

6.1 Recent Experience

Compliance with EU-OPS and/or Part-FCL as appropriate is required for recent experience. The OEB has found no specific recent experience requirements for the G280.

6.2 Currency

The OEB has found no specific currency requirements for the G280.

7. Line Flying Under Supervision (LIFUS) / Familiarization Flights

7.1. Purpose of LIFUS / Familiarization Flights

LIFUS must be performed in accordance with relevant EU-OPS requirements. There are a variety of reasons why the OEB may specify LIFUS / Familiarization Flights.
One or more of the reasons described below may apply:

a. Introduction of new aircraft types or variants;
b. Introduction of new systems (e.g., FMS, ECL, TCAS, HUD);
c. Introduction of new operation (e.g. oceanic, polar or ETOPS operations);
d. Experience for a particular crew position (e.g. PIC, SIC);
e. Post qualification skill refinement (e.g. refining alternate or multiple ways to use particular equipment to increase operating efficiency, operating flexibility, or convenience); or
f. Special characteristics (e.g. airport category in accordance with EU-OPS 1.975, mountainous areas, unusual or adverse weather, special air traffic control procedures, non-standard runway surfaces and dimensions, etc.).

7.2 LIFUS following G280 Type Rating Courses

In the case of pilots completing the initial type rating for the G280, it is recommended that a minimum of 8 sectors LIFUS should be performed, followed by a 2 sector line check. Where there is a change of operating conditions or route structure this should also be taken into account and may need the addition of sectors to cover these elements.