APPENDIX K: FLIGHT CREW TRAINING

KEY MESSAGE

The European CCO / CDO Task Force recommends that Aircraft Operators develop specific training material on CCO / CDO to increase awareness and proactive management of flights. The European CCO / CDO Task Force will develop a Computer-Based Training (CBT) and associated visual aids to support Aircraft Operator refresher training materials.

The Task Force also recommends that CCO / CDO should be included as a competence in initial line and recurrent training together with the inclusion of specific CCO / CDO training practices in their Operations Manuals. This will ensure that Flight Crews are continuously trained on the best flying techniques for the specific airplane they fly.

The Task Force is also proposing specific updates to the training objectives for private and commercial licenses in the relevant Flight Crew Licensing (FCL) Regulations or ATO Training Manuals.

K1: General principles

CCO and CDO are aircraft operating techniques enabled by airspace design, instrument procedure design and facilitated by ATC. As operating techniques, it is essential that Flight Crew are properly trained on the different techniques that can be applied, depending on the traffic circumstances, different operational scenarios and tactical instructions received from ATC. Although both CCOs and CDOs may both provide performance benefits, Flight Crew training material is mostly focused on CDO as the descent phase is the phase that may be subject to many different situations that may require the use of specific pilot techniques. In addition, with the ATC CONOPS usually enabling a CCO to the extent possible (although this may change in the future – see appendix H), the Task Force has demonstrated that the level of fuel burn / emissions benefits available in the climb phase is only approximately one-tenth of those available from optimising the descent phase. This appendix therefore proposes to concentrate primarily on recommendations for Flight Crew training on CDO.

When ATC conditions allow, and in order for airlines / crews to achieve a high rate of CDO compliance, understanding the benefits associated with a CDO (environmental impact, passenger comfort and fuel burn reduction) is vital. So the first step in having Flight Crews that try to perform their best in all conditions, even if these conditions are not optimal for carrying out a CCO / CDO, is to have a training system that embeds techniques in the training program (initial and recurrent) and continually re-inforce the importance of applying these techniques in all operations.

This holds true for both the theoretical background (e.g. on aircraft performance and CDO itself) and practical operational aspects. For airlines / Flight Crews to successfully enhance the efficiency of the vertical profiles, theory needs to be complemented with practice in order to increase awareness and proactive management of the flight.

The Task Force agrees that classroom exercises and reading prescribed materials alone is not enough and unlikely to be the right approach to boosting the Flight Crews' CDO performance. Specific training with clear practical examples can teach more effectively than theory. It is a great help if management – airlines' and regulators' – put the right emphasis on training Not only will resources be then made available, but the commitment shown at high levels in the airline and the regulator will convince those who need to change their attitude.

The Task Force is aware of the fact that practical simulator pilot training is already very demanding and many different scenarios need to be practiced in a limited amount of time, with time available in simulators being a scarce resource. This is why the following recommendations are meant to integrate CCO / CDO as a competency in training, not just as stand-alone exercise in the simulator with integrated CCO / CDO flying techniques.

Recommendations in this Appendix try to cover both initial and recurrent training. For the initial Flight Crew training, the recommendations are for the Regulatory Authorities to include the prescribed CCO / CDO training in the learning objectives for all Flight Crew licenses and class / type rating training. **This can be achieved by inserting them into the FCL Licensing Regulations, which should be done by the regulators, or by the Aviation Training Organisations (ATOs) when developing the training programmes of each course, so they include these learning objectives as best training practices.**

At the time of delivering this Action Plan, the Task Force has made a proposal to EASA to include more specific Flight Crew training learning objectives on CCO / CDO in the relevant regulations. EASA has taken note of this proposal and a decision is pending if it can be included in the EASA Environmental Strategy, which will be developed in 2020.

It should be noted that any proposal to modify the regulatory requirements or training course syllabi is made as a way forward or 'tool box', offering ideas for possible ways of implementation. It is for the responsible people to implement these proposals the way they best consider appropriate, following their own rulemaking / course approval processes.

For recurrent training, recommendations are for the airlines to include specific CCO / CDO training practices in their Operations Manuals, so that Flight Crews are continuously trained on the best flying techniques for the specific airplane they fly.

K2: Initial Training

In order to have CDO included in initial training for ALL Pilots, the regulator should include the following learning objectives in the respective section of the regulation(s) – note that text in bold below represents new proposals outside of current regulatory text:

1. **For private licenses:**
    a. Theoretical training: OPERATIONAL PROCEDURES. General Operation of aircraft: ICAO. Annex 6, General requirements:
        i. Noise abatement;
        ii. Noise abatement procedures;
        iii. Influence of the flight procedure (departure, cruise, descent and approach) on noise and fuel efficiency (CCO / CDO procedures);
    b. Practical training: Each of the exercises in the Syllabus of flight instruction involves the need for the applicant to be aware of the good airmanship and look-out, which should be emphasised at all phases of flight, especially during:
        i. Climbing: entry, maintaining the normal and max rate climb and levelling off, **Continuous Climb Operations;**
        ii. levelling off at selected altitudes;
        iii. Descending: glide, powered and cruise descent (including effect of power and air speed), **Continuous Descent Operations.**

2. **For Commercial licenses:**
    a. Theoretical training.
        i. Name the conditions that must be adhered to when two aircraft are cleared to maintain a specified vertical separation between them during climb or descent. **State CCO and CDO definitions** Source: ICAO Doc 4444, Chapter 5, 5.3.4 Vertical separation during climb or descent
        ii. Environmental requirements:

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        - **Reference to global and EU Environmental Regulations**
        - **Effects of non-optimal cruising levels**
        - **CCO / CDO and Pilot techniques:**
            - **Closed Paths and restriction compliance**
            - **Speed management**
            - **Vertical speed management**
        - **Piloting techniques for:**
            - **Path stretching**
            - **Open Paths**
            - **Vectoring**
        - **Importance of DTG**

b. Practical training: at the proper flying instruction phase:
    i. Exercises up to the instrument rating skill test comprise procedures and manoeuvres for IFR operation under normal, abnormal and emergency conditions covering at least, among others:
        - SIDs and arrivals, **with the application of proper CCO and CDO techniques.**

3. For the MPL license:

a. List of competency elements and performance criteria during climb should include how to select and maintain the appropriate climb speed or rate of climb, **according to CCO good practices;**
b. List of competency elements and performance criteria during descent should include the initiation and management of the descent, **according to CDO good practices.**

4. For the Class / Type Rating training:

a. Type Rating Courses content should cover:
    i. Aircraft energy management:
        - Speed management: economy speed vs selected;
        - ATC tactical manoeuvring: manage automation modes to optimise descent.
    ii. Piloting Techniques:
        - Starts descent according to ATC clearance or optimum descent point;
        - Selects optimum speed and descent rate;
        - Adjusts speed to existing environmental conditions;
        - Recognises the need to adjust the descent path;
        - Adjusts the flight path as required;
        - Utilises all means of FMS descent information.
    iii. Closed Paths and compliance with published constraints and the use of FMS, speed management;
    iv. Piloting techniques for:
        - Path stretching;
        - Open Paths;
        - Vectoring;
    v. Importance of DTG

K3: Recurrent training

Including CCO / CDO as a competence in the Flight Crew Line Training is held to be a good practice for keeping Crews fully appraised of the importance of using the most efficient flying techniques throughout a flight.

Having CDO as a competence ensures that CDO techniques are taught and that the Pilot undergoing training will demonstrate proficiency in line checks before the final sign-off to line operation can take place. It instils a CDO mentality from day one of their airline training.

This has been observed to be very useful for Pilots - especially those who come from backgrounds where CDO is not traditionally considered to be a required flying technique. But if it is to be considered essential, Flight Crews would always attempt to conduct a CDO (ATC, Approach type and SOPs permitting). It has been previously demonstrated that, where CDO-trained Flight Crew have moved to another airline, this airline has subsequently experienced an improvement in CDO.

It should be noted that simulator training costs may incur significant costs to Operators. In an ideal world, Flight Crew refresher training should include both theory and practical training. Flight Crew refresher training usually includes many mandatory exercises that are required by EASA and the simulator schedule may already be full. In these cases, refresher training may be supported by theory and other visual aids such as CBT, video or animations as alternate resources to pass on clear messages.

The European CCO / CDO Task Force considers that airline refresher training courses in the Operation Manual, Part D, should, at the very minimum, include the following items regarding CDO:

- **Aircraft energy management:**
  - i. Speed management: economy speed vs selected
  - ii. ATC tactical manoeuvring
  - iii. Factors that influence optimised vertical profile
  - iv. Rules of thumb for descent:
    - ToD in nm = altitude (in 000's ft) x 3 + margin
    - 1 knot speed reduction = 1 kg fuel saved, but 3 seconds more time flown

- **Good Practice Piloting Techniques:**
  - i. Closed Path restriction compliance
  - ii. Speed management
  - iii. Vertical speed management
  - iv. Piloting techniques for:
    - Path stretching
    - Open Paths
    - Vectoring
  - v. Importance of DTG

- **ATC tactical interventions:**
  - i. Factors taken into account by ATC for tactical management of aircraft
    - Speed Control
    - Vectoring
    - Departures versus arrivals
  - ii. What ATC expect from Flight Crew to be able to facilitate CCO / CDO

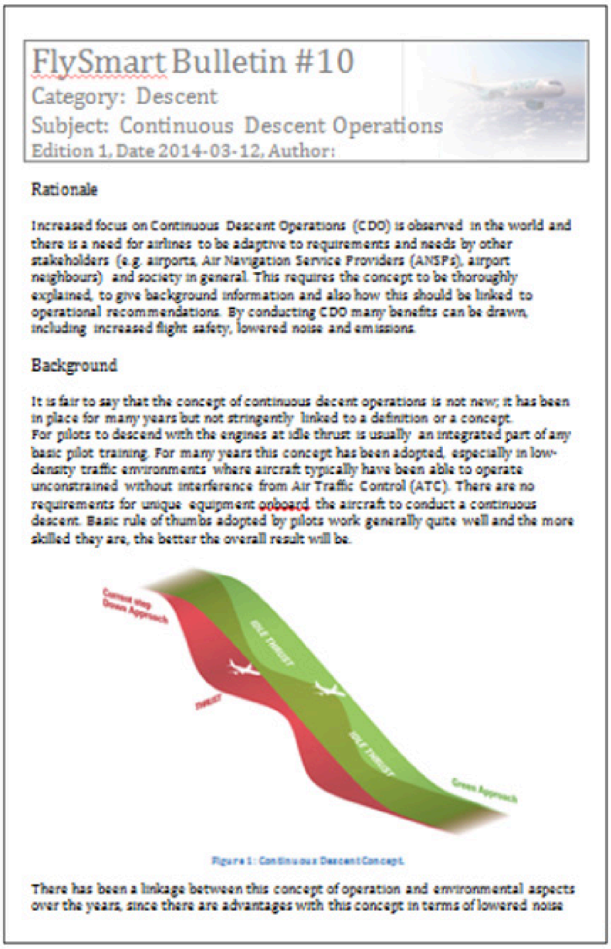
These messages may be passed on ideally in theory and practical training. Should simulator slots not be available, the European CCO / CDO Task Force will be developing a CBT and associated visual aids to support Aircraft Operator refresher training materials.

The above-proposed minimum structure for an airline refresher training course will be updated once there is a clear proposed structure for the CBT as proposed by Task Force Pilot representatives.

Some examples from industry have also demonstrated the benefits of having specific training policies e.g.:

- Training and using specially trained Pilots, acting as Fuel Coaches. The purpose is for these Fuel Coaches to share good practice during normal flight operations with other colleagues, and this includes aspects related to CDO;
- Developing training material that focuses specifically on the management of the profile in non-standard situations, tailored for the destinations flown, especially the home base;
- Developing a web-based training as a follow up for the different situations experienced with their home base projects, such as the HTO (High Transition Operations) project (see Appendix Q). These may take a holistic view or zoom in on non-standard situations that have been experienced over time;
- Using performance monitoring tools to update Standard Operating Procedures, in order to align them with identified good practices; and,
- Dissemination of CDO performance information through dedicated regular training Newsletters.

Some airline examples that may be considered as good practices are detailed below:



FlySmart Bulletin #10
Category: Descent
Subject: Continuous Descent Operations
Edition 1, Date 2014-03-12, Author:

Rationale

Increased focus on Continuous Descent Operations (CDO) is observed in the world and there is a need for airlines to be adaptive to requirements and needs by other stakeholders (e.g. airports, Air Navigation Service Providers (ANSPs), airport neighbours) and society in general. This requires the concept to be thoroughly explained, to give background information and also how this should be linked to operational recommendations. By conducting CDO many benefits can be drawn, including increased flight safety, lowered noise and emissions.

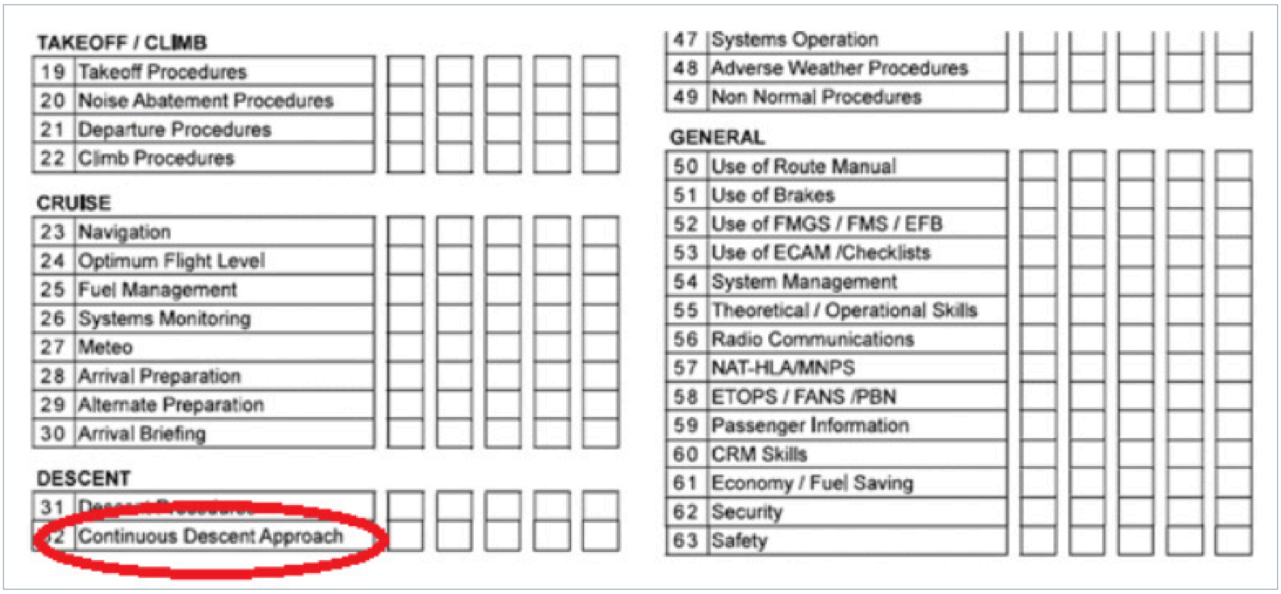
Background

It is fair to say that the concept of continuous decent operations is not new; it has been in place for many years but not stringently linked to a definition or a concept.
For pilots to descend with the engines at idle thrust is usually an integrated part of any basic pilot training. For many years this concept has been adopted, especially in low-density traffic environments where aircraft typically have been able to operate unconstrained without interference from Air Traffic Control (ATC). There are no requirements for unique equipment onboard the aircraft to conduct a continuous descent. Basic rule of thumbs adopted by pilots work generally quite well and the more skilled they are, the better the overall result will be.

Figure 1: Continuous Descent Concept.

There has been a linkage between this concept of operation and environmental aspects over the years, since there are advantages with this concept in terms of lowered noise

Figure 46: Example on theoretical CDO guidance material.



TAKEOFF / CLIMB

19	Takeoff Procedures	☐	☐	☐	☐	☐
20	Noise Abatement Procedures	☐	☐	☐	☐	☐
21	Departure Procedures	☐	☐	☐	☐	☐
22	Climb Procedures	☐	☐	☐	☐	☐

CRUISE

23	Navigation	☐	☐	☐	☐	☐
24	Optimum Flight Level	☐	☐	☐	☐	☐
25	Fuel Management	☐	☐	☐	☐	☐
26	Systems Monitoring	☐	☐	☐	☐	☐
27	Meteo	☐	☐	☐	☐	☐
28	Arrival Preparation	☐	☐	☐	☐	☐
29	Alternate Preparation	☐	☐	☐	☐	☐
30	Arrival Briefing	☐	☐	☐	☐	☐

DESCENT

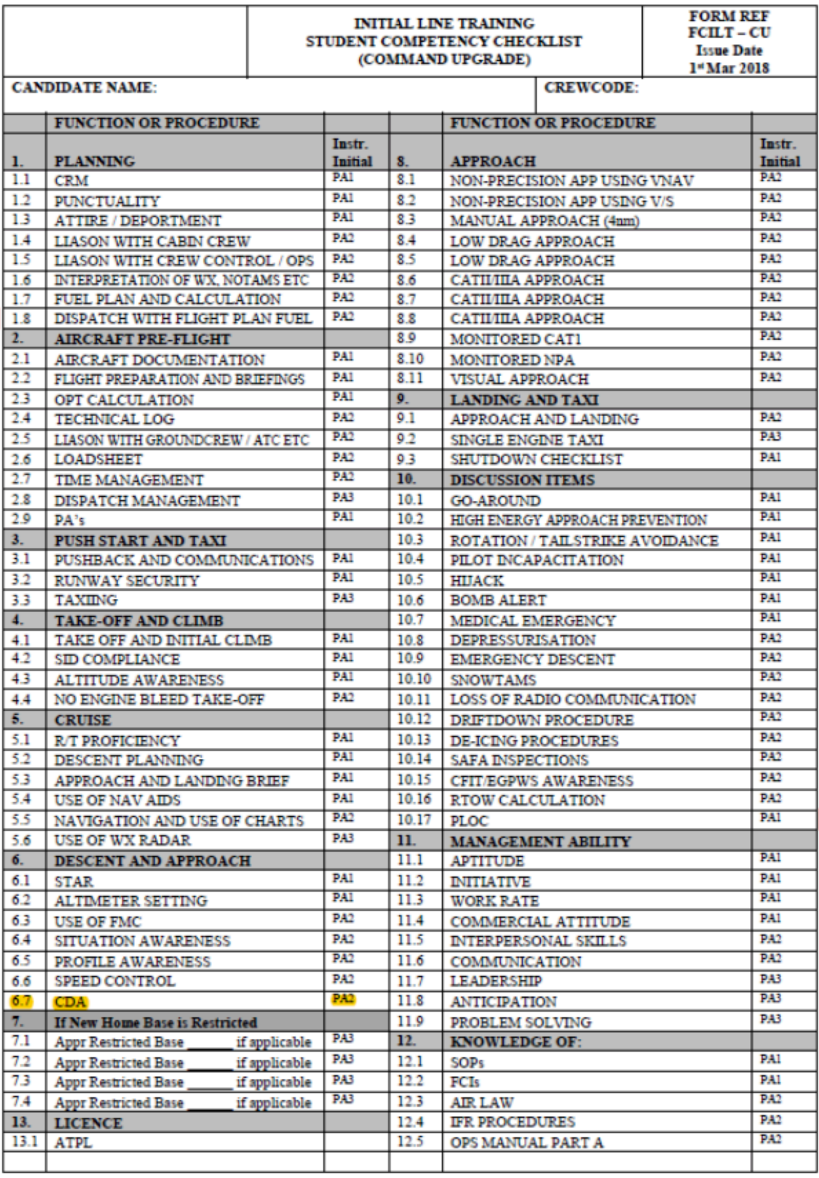
31	Descent Procedures	☐	☐	☐	☐	☐
2	Continuous Descent Approach	☐	☐	☐	☐	☐

47	Systems Operation	☐	☐	☐	☐	☐
48	Adverse Weather Procedures	☐	☐	☐	☐	☐
49	Non Normal Procedures	☐	☐	☐	☐	☐

GENERAL

50	Use of Route Manual	☐	☐	☐	☐	☐
51	Use of Brakes	☐	☐	☐	☐	☐
52	Use of FMGS / FMS / EFB	☐	☐	☐	☐	☐
53	Use of ECAM /Checklists	☐	☐	☐	☐	☐
54	System Management	☐	☐	☐	☐	☐
55	Theoretical / Operational Skills	☐	☐	☐	☐	☐
56	Radio Communications	☐	☐	☐	☐	☐
57	NAT-HLA/MNPS	☐	☐	☐	☐	☐
58	ETOPS / FANS /PBN	☐	☐	☐	☐	☐
59	Passenger Information	☐	☐	☐	☐	☐
60	CRM Skills	☐	☐	☐	☐	☐
61	Economy / Fuel Saving	☐	☐	☐	☐	☐
62	Security	☐	☐	☐	☐	☐
63	Safety	☐	☐	☐	☐	☐

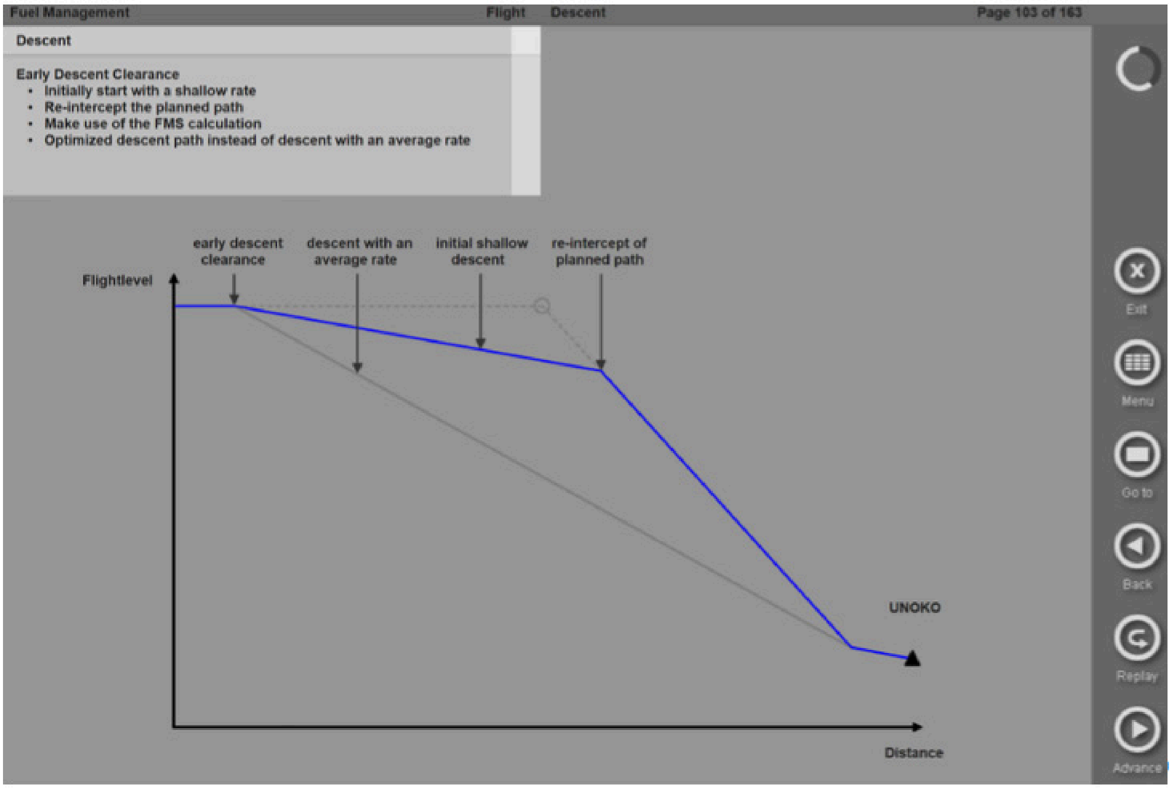
Figure 47: Example of CDO included in the training syllabus for Flight Crew Conversion training and checking AND Flight Crew Refresher Training



	INITIAL LINE TRAINING STUDENT COMPETENCY CHECKLIST (COMMAND UPGRADE)	FORM REF FCILT – CU Issue Date 1st Mar 2018
CANDIDATE NAME:		CREWCODE:

	FUNCTION OR PROCEDURE			FUNCTION OR PROCEDURE	
1.	PLANNING	Instr. Initial	8.	APPROACH	Instr. Initial
1.1	CRM	PA1	8.1	NON-PRECISION APP USING VNAV	PA2
1.2	PUNCTUALITY	PA1	8.2	NON-PRECISION APP USING V/S	PA2
1.3	ATTIRE / DEPORTMENT	PA1	8.3	MANUAL APPROACH (4nm)	PA2
1.4	LIASON WITH CABIN CREW	PA2	8.4	LOW DRAG APPROACH	PA2
1.5	LIASON WITH CREW CONTROL / OPS	PA2	8.5	LOW DRAG APPROACH	PA2
1.6	INTERPRETATION OF WX, NOTAMS ETC	PA2	8.6	CATII/IIIA APPROACH	PA2
1.7	FUEL PLAN AND CALCULATION	PA2	8.7	CATII/IIIA APPROACH	PA2
1.8	DISPATCH WITH FLIGHT PLAN FUEL	PA2	8.8	CATII/IIIA APPROACH	PA2
2.	AIRCRAFT PRE-FLIGHT		8.9	MONITORED CAT1	PA2
2.1	AIRCRAFT DOCUMENTATION	PA1	8.10	MONITORED NPA	PA2
2.2	FLIGHT PREPARATION AND BRIEFINGS	PA1	8.11	VISUAL APPROACH	PA2
2.3	OPT CALCULATION	PA1	9.	LANDING AND TAXI	
2.4	TECHNICAL LOG	PA2	9.1	APPROACH AND LANDING	PA2
2.5	LIASON WITH GROUNDCREW / ATC ETC	PA2	9.2	SINGLE ENGINE TAXI	PA3
2.6	LOADSHEET	PA2	9.3	SHUTDOWN CHECKLIST	PA1
2.7	TIME MANAGEMENT	PA2	10.	DISCUSSION ITEMS	
2.8	DISPATCH MANAGEMENT	PA3	10.1	GO-AROUND	PA1
2.9	PA's	PA1	10.2	HIGH ENERGY APPROACH PREVENTION	PA1
3.	PUSH START AND TAXI		10.3	ROTATION / TAILSTRIKE AVOIDANCE	PA1
3.1	PUSHBACK AND COMMUNICATIONS	PA1	10.4	PILOT INCAPACITATION	PA1
3.2	RUNWAY SECURITY	PA1	10.5	HIJACK	PA1
3.3	TAXIING	PA3	10.6	BOMB ALERT	PA1
4.	TAKE-OFF AND CLIMB		10.7	MEDICAL EMERGENCY	PA1
4.1	TAKE OFF AND INITIAL CLIMB	PA1	10.8	DEPRESSURISATION	PA2
4.2	SID COMPLIANCE	PA1	10.9	EMERGENCY DESCENT	PA2
4.3	ALTITUDE AWARENESS	PA1	10.10	SNOWTAMS	PA2
4.4	NO ENGINE BLEED TAKE-OFF	PA2	10.11	LOSS OF RADIO COMMUNICATION	PA2
5.	CRUISE		10.12	DRIFTDOWN PROCEDURE	PA2
5.1	R/T PROFICIENCY	PA1	10.13	DE-ICING PROCEDURES	PA2
5.2	DESCENT PLANNING	PA1	10.14	SAFA INSPECTIONS	PA2
5.3	APPROACH AND LANDING BRIEF	PA1	10.15	CFIT/EGPWS AWARENESS	PA2
5.4	USE OF NAV AIDS	PA1	10.16	RTOW CALCULATION	PA2
5.5	NAVIGATION AND USE OF CHARTS	PA2	10.17	PLOC	PA1
5.6	USE OF WX RADAR	PA3	11.	MANAGEMENT ABILITY	
6.	DESCENT AND APPROACH		11.1	APTITUDE	PA1
6.1	STAR	PA1	11.2	INITIATIVE	PA1
6.2	ALTIMETER SETTING	PA1	11.3	WORK RATE	PA1
6.3	USE OF FMC	PA2	11.4	COMMERCIAL ATTITUDE	PA1
6.4	SITUATION AWARENESS	PA2	11.5	INTERPERSONAL SKILLS	PA2
6.5	PROFILE AWARENESS	PA2	11.6	COMMUNICATION	PA2
6.6	SPEED CONTROL	PA2	11.7	LEADERSHIP	PA3
6.7	CDA	PA2	11.8	ANTICIPATION	PA3
7.	If New Home Base is Restricted		11.9	PROBLEM SOLVING	PA3
7.1	Appr Restricted Base ______ if applicable	PA3	12.	KNOWLEDGE OF:	
7.2	Appr Restricted Base ______ if applicable	PA3	12.1	SOPs	PA1
7.3	Appr Restricted Base ______ if applicable	PA3	12.2	FCIs	PA1
7.4	Appr Restricted Base ______ if applicable	PA3	12.3	AIR LAW	PA2
13.	LICENCE		12.4	IFR PROCEDURES	PA2
13.1	ATPL		12.5	OPS MANUAL PART A	PA2

Figure 48: Example of CDA requirements in the Flight Crew Initial Line Training



Descent

Early Descent Clearance

- Initially start with a shallow rate
- Re-intercept the planned path
- Make use of the FMS calculation
- Optimized descent path instead of descent with an average rate

Figure 49: Excerpt from an airline CBT on fuel management