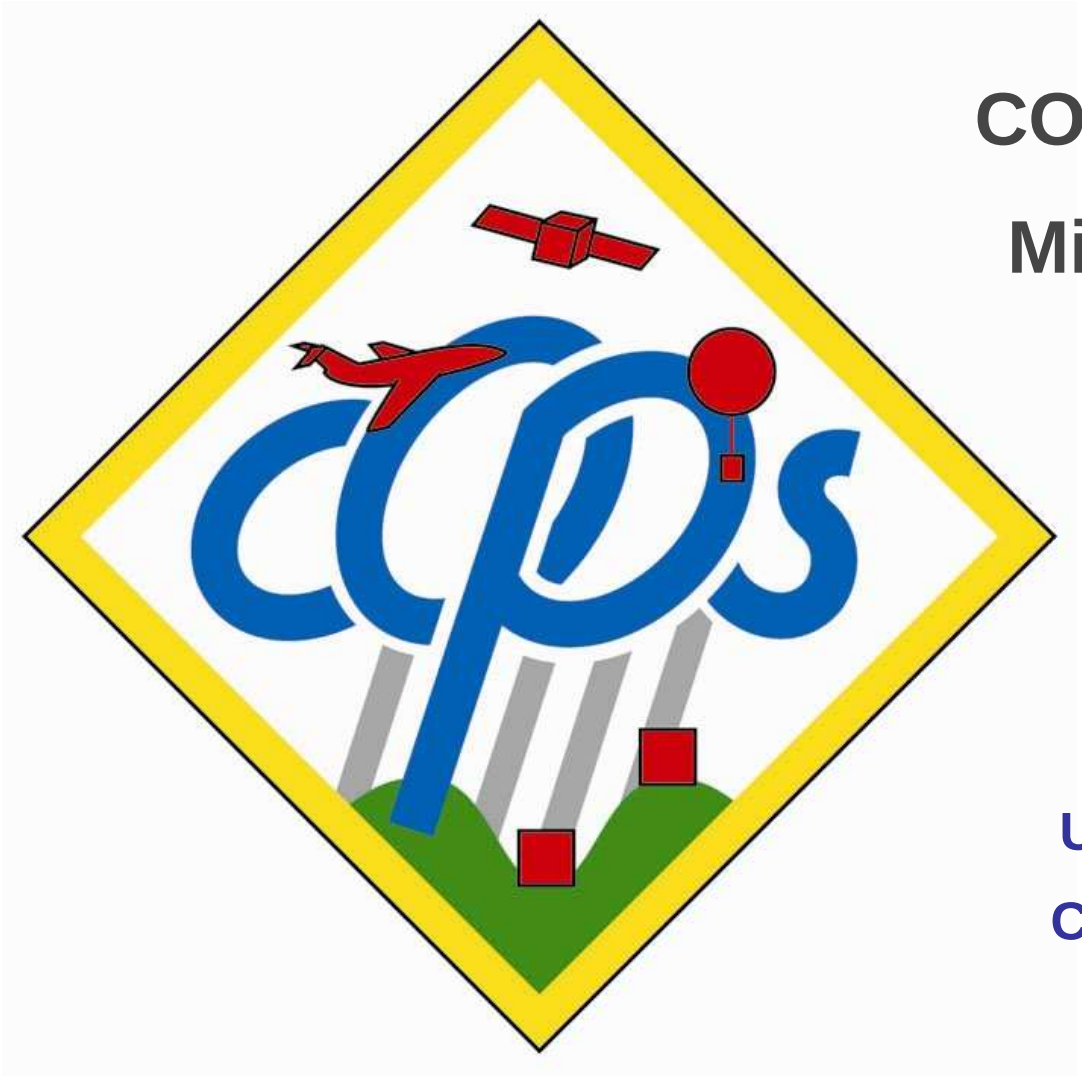


COPS and TRACKS

Mission Overview

Short version

Ulrich Corsmeier, FZK

Christoph Kiemle, DLR

Version 2.0 (09.06.07)

COPS and TRACKS: **Overview and General Aspects**

Associated to the COPS field experiment is the TRACKS (Transport and Chemical Conversion in Convective Systems) campaign. For aircraft deployment in COPS and TRACKS five mission scenarios were defined:

Scenario “Forced Convection” (COPS)

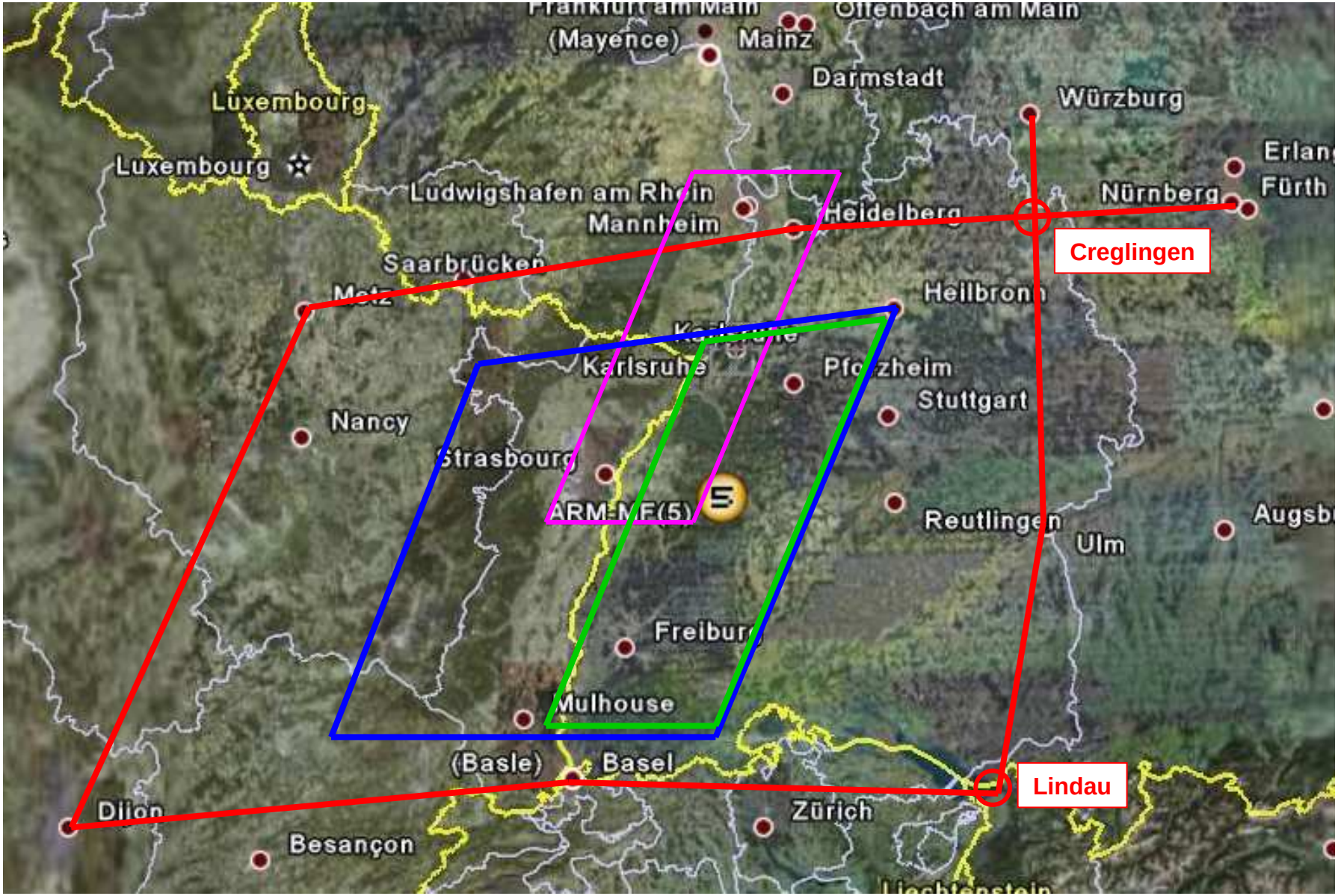
Scenario “High Pressure Convection” (COPS, TRACKS)

Scenario “Targeted Observations” (COPS)

Scenario „Stratus – Cloud Physics“ (COPS)
funded by EUFAR (2 proposals)

Scenario “City Plume” (TRACKS)

Area under Investigation: COPS area with sub areas blue and green
TRACKS areas green and pink



Coordinates of COPS area with sub-areas blue and green

and

Coordinates of TRACKS areas green and pink

Area	NW (N)	NE	SE (S)	SW
RED	6.1622 E, 49.1143 N Metz (8.6842 E, 49.4140 N Heidelberg)	10.0327 E, 49.4772 N Creglingen	9.6721 E, 47.5532 N Lindau (7.5795 E 47.5553 N Basel)	Dijon
BLUE	7.0206 E, 48.8433 N Fenetrange	9.2248 E, 49.1523 N Heilbronn	8.2709 E, 47.6383 N Tiengen	6.4996 E 47.6847 N Lure
GREEN	8.2273 E, 49.0005 N Karlsruhe	9.2248 E, 49.1523 N Heilbronn	8.2709 E, 47.6383 N Tiengen	7.5092 E 47.6624 N Efringen-Kirchen
PINK	8.1769 E, 49.5700 N Grünstadt	8.9476 E, 49.5678 N Beerfelden	8.1667 E, 48.4329 N Bad Peterstal	7.4662 E, 48.4162 N Barr

Overview of COPS and TRACKS Airborne Platforms

(all mission scenarios)

Ac-No.	Aircraft and location	Principal Investigator	Range km	Height km	Operation times, flight hours	Endurance h Speed m/s	Key instruments except standard met.	Project
1	**Learjet 35A,** Hohn	Horst Fischer, Mark Lawrence hofi@mpch-mainz.mpg.de, lawrence@mpch-mainz.mpg.de		up to 13 (FL 400)	**16.- 28.07.** 4 flights	3,5 (4 h prep. time) tbd	Photochemistry	**TRACKS**
2	**G - Falcon,** Oberpfaffen-hofen	Gerhard Ehret, Christoph Kiemle Gerhard.Ehret@dlr.de Christoph.Kiemle@dlr.de	2100 - 3700	4 -12	**28.06.-05.08.** 45 h	4 -5 120	WV DIAL, Doppler lidar, dropsondes	**COPS**
3	**F- Falcon,** Baden-Airpark	Cyrille Flamant Cyrille.Flamant@aero.jussieu.fr	2000	5 - 6	**10.07.-02.08.** 35 h **+ 9 h**	4 200	WV DIAL, dropsondes	**COPS (partly EUFAR)**
4	**BAE 146,** Baden-Airpark	Stephen Mobbs Stephen@env.leeds.ac.uk		up to 8	**June-August** 80 h	tbd 100	Aerosol, cloud micro-physics, trace gases	**COPS TRACKS**
5	**DO-128,** Baden-Airpark	Ulrich Corsmeier Ulrich.Corsmeier@imk.fzk.de	800	up to 7	**11.06.-31.07.** 125 h	3.5 65	Tracer, fluxes, radiation	**COPS TRACKS**
6	**Dimona HK-36,** Baden-Airpark	Bruno Neininger, Heiner Geiß, Jan Schween bruno.neininger@metair.ch h.geiss@fz-juelich.de	800	up to 4	**16.- 31.07.** (4 days) **+10 h**	4 – 5 40	Photochemistry tracer, wind, turbulence	**TRACKS COPS (EUFAR)**
7	**FZJ Zeppelin NT,** Friedrichshafen, Baden-Airpark	Frank Holland, A. Hofzumahaus F.Holland@fz-juelich.de A.Hofzumahaus@fz-juelich.de	550	0.02 – 1.0	**16.- 31.07.** tbd	10 0-25	Photochemistry	**TRACKS**
8	**UL Enduro,** Baden-Airpark	Wolfgang Junkermann Wolfgang.Junkermann@imk.fzk.de	500	0.02 - 4.5	**15.- 30.06. 19.- 28.07.** ~ 4-5h /day	6 25	Radiation, aerosol, turbulence	**COPS TRACKS**
9	**Partenavia P68** Baden-Airpark	Christine Brandau C.Brandau@irctr.tudelft.nl	800	up to 4	**July/Aug. 10 h**	4 65	Aerosol, cloud micro-physics	**COPS (EUFAR)**
10	**ATR 42** Baden-Airpark	Yann Dufournet Y.Dufournet@irctr.tudelft.nl			**18.- 29.07. 10 h**			**COPS (EUFAR)**

Availability of COPS Airborne Platforms

(all mission scenarios; colour code: area of operation)

	Juni 2007																													
Platform	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Learjet																														
G-Falcon																														
F-Falcon																														
BAE-146																														
DO 128																														
Dimona																														
Zeppelin																														
Enduro																														
Partenavia																														
ATR 42																														

	Juli 2007																														
Platform	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Learjet																															
G-Falcon																															
F-Falcon																															
BAE-146										2		d	o	w	n	d	a	y	s		w	i	t	h	i	n					
DO 128																															
Dimona																															
Zeppelin																															
Enduro																															
Partenavia																															
ATR42																															

Availability of COPS Airborne Platforms

(all mission scenarios; colour code: area of operation)

	August 2007																														
Platform	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Learjet																															
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Zeppelin																															
Enduro																															
Partenavia																															
ATR42																															

In the following slides, each of the 5 COPS and TRACKS mission scenarios is explained in detail with maps, lists of participating aircraft and timelines.

Scenario “Forced Convection”

Areas and Layers of Operation of Airborne Platforms

Aircraft No.	Aircraft	Area	Flight level (Flight layer)	IFR/VFR Operation
1	Learjet	GREEN	~ FL 370	IFR
2	G-Falcon (D-CMET)	RED	FL 330	IFR
3	F-Falcon	RED	FL 150	IFR
4	BAE 146	RED	< FL 100 FL 100/240	VFR IFR
5	DO-128 (D-IBUF)	BLUE	< FL 100 FL 240	VFR IFR
6	Dimona	GREEN	< FL 100	VFR
7	Zeppelin NT	GREEN	< FL 100	VFR
8	UL Enduro	GREEN	< FL 100	VFR
9	Partenavia P68	No participation in “Forced Convection”		
10	ATR42	No participation in “Forced Convection”		

Mission Scenario "Forced Convection"

*: VFR

Blue Sky --- > Shallow Convection -- > Deep Convection-- > Dis. Convection

forced, non frontal/frontal

07—08--09---10---11---12---13---14---15---16---17---18---19---20---21---22 local

Learjet ----------4 BOX pattern, tropopause -------4 BOX pattern, outflow anvil----------
----------FL 370, low appr. EDSB ---------- FL 370, low appr. EDSB ----------

G-Falcon ----------MAP pattern (2 MAPs) -------→MAP pattern CuCong, Cb ----------
----------FL 330 ----------→FL 330 ----------

F-Falcon ----------MAP pattern (1 MAP) ---------→MAP pattern CuCong, Cb----------
----------FL 160 ----------→FL160 (Area A, B deactivated) ----------

(*)BAE 146----------LONG-LEGS, V-legs-----→PENETRATION Cb----------
----------VFR < FL 100----------→FL 200/240 ----------

(*)DO 128--------PreCon pattern----SupDe pattern (3x)--------DROP pattern (DeDe)----------
--------low PBL (VFR)------low, mid PBL, BL-Inv ---up to FL 200/240, DROPS Area A, ----------

*Zeppelin--Valley pattern (Rhine-Kinzig-Murg-Nagold)----------Valley pattern (R-K-M-N)--→CuCong----
---lowest level, VFR----------lowest level, VFR----------→on request-

*Dimona----------MAP (2 MAPs) or Valley----------MAP (2 MAPs) or Valley----------
----------lowest level PBL (VFR)----------lowest level PBL (VFR)----------

*Enduro----------Triangle or Cross-Sec., profiles ------Triangle or Cross-Sec., profiles ----------
----------low PBL, FL100 (VFR)----------low PBL, FL100 (VFR)----------

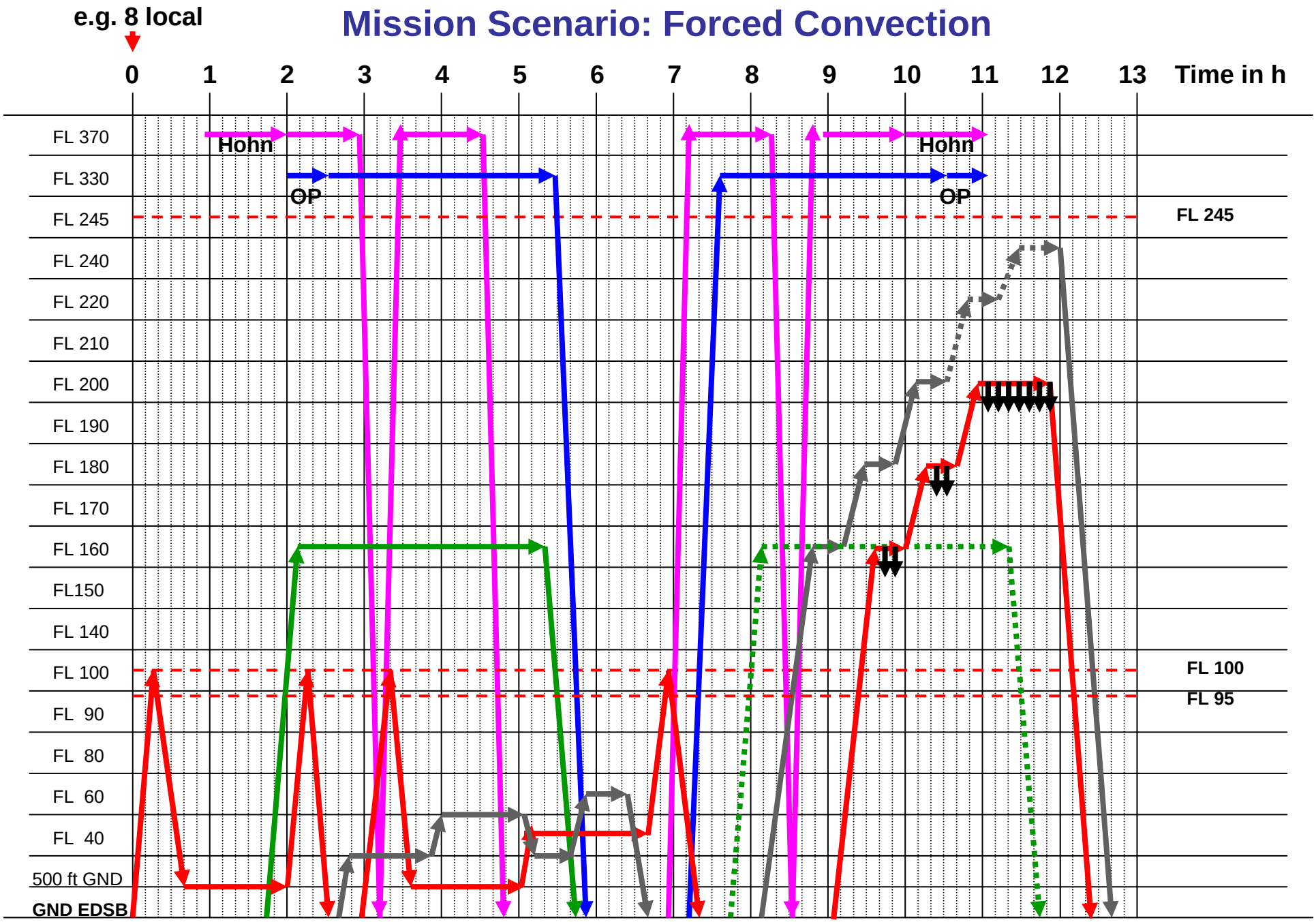
Mission scenario “Forced Convection”
Missions above FL100:

Learjet
German Falcon
French-Falcon
BAe 146
Do 128

 Dropsonde release over German territory

Remarks:

1. **F-Falcon dashed mission: only** if drop sonde areas **A** and **B** are **deactivated**
2. **BAe 146 climbing to FL 240 on request and approval**
3. **DO 128 climbing and dropping on FL 240 on request and approval**
4. **Upper boundary for VFR flights: FL 100 in Germany, FL 95 in France**


e.g. 8 local
Mission Scenario: Forced Convection
0
1
2
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10
11
12
13
Time in h
FL 370
FL 330
FL 245
FL 240
FL 220
FL 210
FL 200
FL 190
FL 180
FL 170
FL 160
FL150
FL 140
FL 100
FL 90
FL 80
FL 60
FL 40
500 ft GND
GND EDSB
Hohn
OP
Hohn
OP
FL 245
FL 100
FL 95

Scenario “High Pressure Convection”

Areas and Layers of Operation of Airborne Platforms

Aircraft No.	Aircraft	Area	Flight level (Flight layer)	IFR/VFR Operation
1	Learjet	No participation in “High Pressure Convection”		
2	G - Falcon (D-CMET)	RED	FL 170	IFR
3	F - Falcon	RED	FL 150	IFR
4	BAE 146	RED	< FL 100, FL 100/240	VFR IFR
5	DO-128 (D-IBUF)	BLUE	< FL 100 FL 240	VFR IFR
6	Dimona	GREEN	< FL 100	VFR
7	Zeppelin NT	GREEN	< FL 100	VFR
8	UL Enduro	GREEN	< FL 100	VFR
9	Partenavia P68	No participation in “High Pressure Convection”		
10	ATR42	No participation in “High Pressure Convection”		

Mission Scenario A "High Pressure Convection"

*: VFR

Blue Sky --- > Shallow Convection -- > Deep Convection-- > Dis. Convection

non frontal / non forced

07—08--09---10---11---12---13---14---15---16---17---18---19---20---21---22 local

Learjet ----------

G-Falcon ----------FLUX pattern (up to 3 times) ---→MAP pattern CuCon, Cb----------
----------FL 170 ----------→FL 330----------

F-Falcon ----------MAP pattern (1) ---------→MAP pattern CuCong, Cb----------
----------FL 160----------→FL160 **(Area A, B deactivated)** ----------

(*)BAE 146----------LONG-LEGS, V-Legs---→PENETRATION Cb----------
----------VFR < FL 100----------→FL 200/240 ----------

(*)DO 128----------FLUX pattern (2 to 3)----------→DROP pattern (DeDe)----------
----------mid/upper PBL (VFR)----------→up to FL 200/240, **DROPS Area A, B** ----------

***Zeppelin**--Valley pattern (Rhine-Kinzig-Murg-Nagold)----------Valley pattern (R-K-M-N)--→CuCong------
---lowest level, VFR----------lowest level, VFR----------→on request---

***Dimona**----------MAP (2 MAPs) or Valley----------MAP (2 MAPs) or Valley----------
----------lowest level PBL (VFR)----------lowest level PBL (VFR)----------

***Enduro**----------Triangle/Cross-Section/Slope----------Triangle/Cross-Section/Slope----------
----------low PBL, FL100 (VFR)----------low PBL, FL100 (VFR)----------

Mission Scenario B "High Pressure Convection"

*: VFR

Blue Sky --- > Shallow Convection -- > Deep Convection-- > Dis. Convection

non frontal / non forced

07—08--09---10---11---12---13---14---15---16---17---18---19---20---21---22 local

Learjet ----------

G-Falcon ----------

F-Falcon ----------

(*)BAE 146----------LONG-LEGS, V-Legs-------→PENETRATION Cb----------
----------VFR < FL 100----------→FL 200/240 ----------

(*)DO 128----------SS-QC----------CHAFF R/SVs/HL---------SS QC----------
----------VFR < FL 100---------PBL, very low----------VFR < FL 100----------

Alternative

(*)DO 128----------SS-MET----------CHAFF R/SVs/HL--------SS MET----------
----------VFR < FL 100---------PBL, very low----------VFR < FL 100----------

***Zeppelin**--Valley pattern (Rhine-Kinzig-Murg-Nagold)----------Valley pattern (R-K-M-N)--→CuCong----
---lowest level, VFR----------lowest level, VFR----------→on request-

***Dimona**----------MAP (2 MAPs) or Valley----------MAP (2 MAPs) or Valley----------
----------lowest level PBL (VFR)----------lowest level PBL (VFR)----------

***Enduro**----------Triangle/Cross-Section/Slope----------Triangle/Cross-Section/Slope----------
----------low PBL, FL100 (VFR)----------low PBL, FL100 (VFR)----------

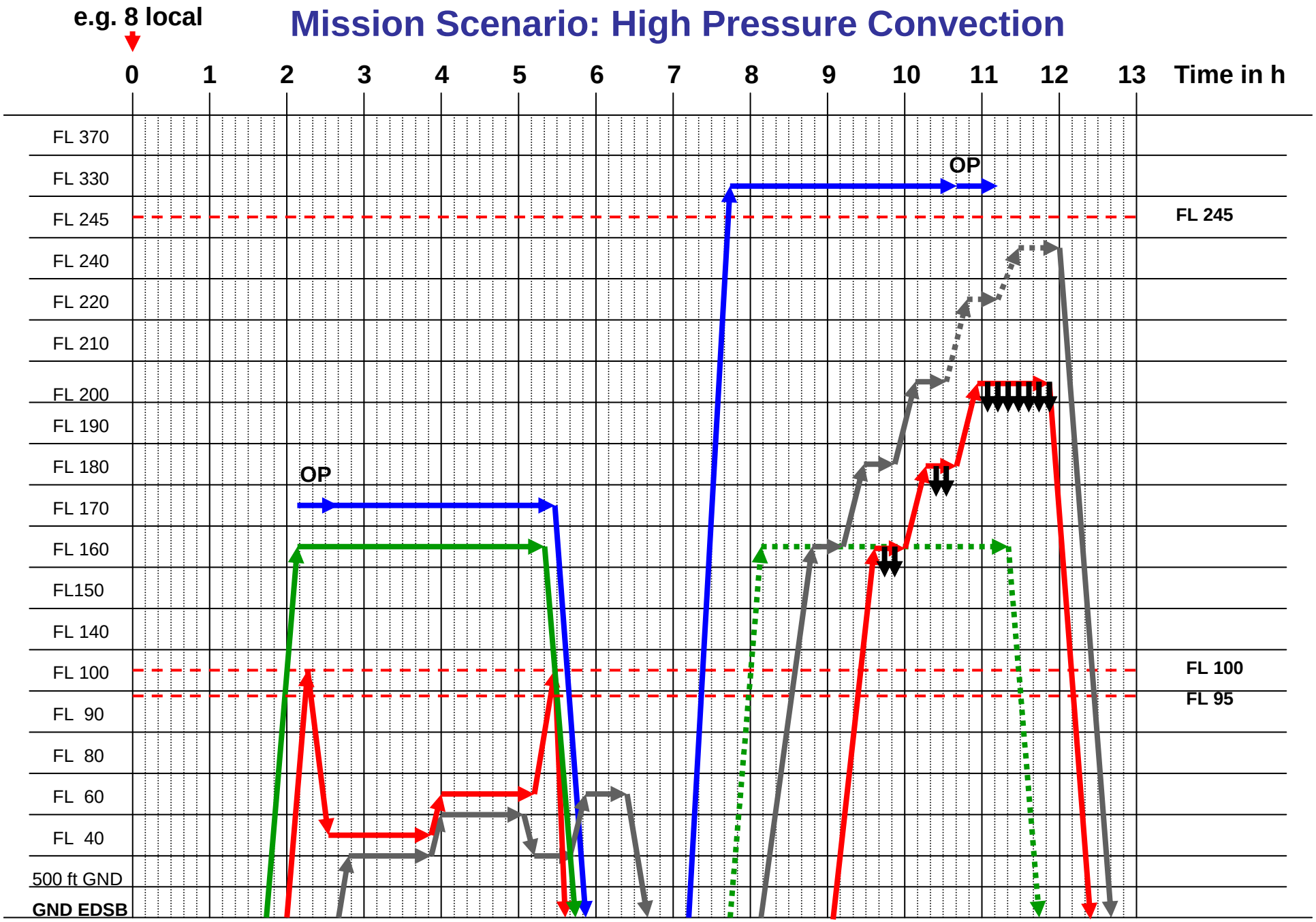
Mission scenario “High Pressure Convection”
Missions above FL100:

German Falcon
French-Falcon
BAe 146
Do 128

 Dropsonde release over German territory

Remarks:

1. **F-Falcon dashed mission: only** if drop sonde areas **A** and **B** are **deactivated**
2. **BAe 146 climbing to FL 240 on request and approval**
3. **DO 128 climbing and dropping on FL 240 on request and approval**
4. **Upper boundary for VFR flights: FL 100 in Germany, FL 95 in France**


e.g. 8 local
Mission Scenario: High Pressure Convection
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12
13
Time in h
FL 370
FL 330
FL 245
FL 240
FL 220
FL 210
FL 200
FL 190
FL 180
FL 170
FL 160
FL150
FL 140
FL 100
FL 90
FL 80
FL 60
FL 40
500 ft GND
GND EDSB
OP
OP
FL 245
FL 100
FL 95

Scenario “Targeted Observations”

Areas and Layers of Operation of Airborne Platforms

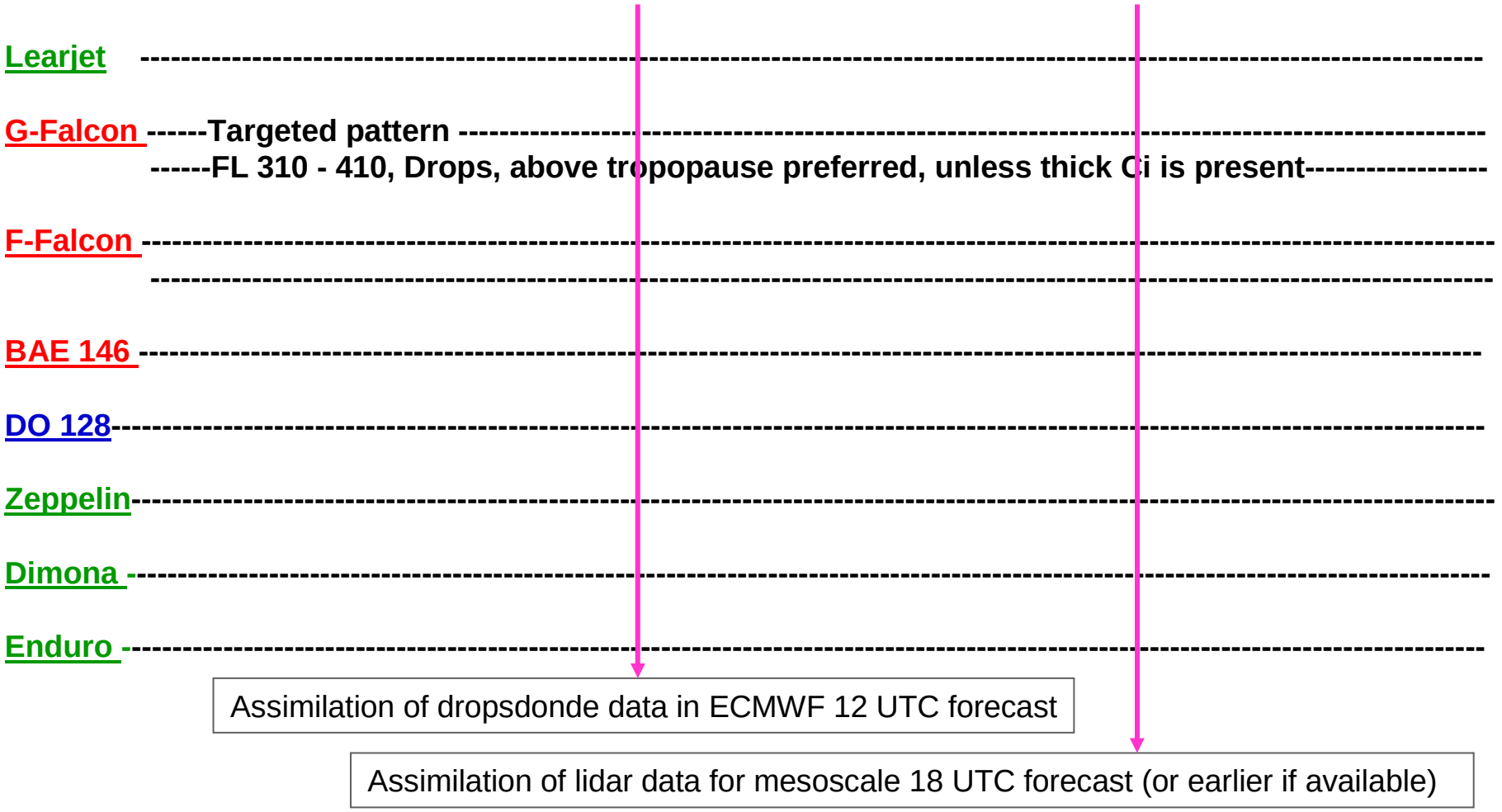
Aircraft No.	Aircraft	Area	Flight level (Flight layer)	IFR/VFR Operation
1	Learjet	No participation in “Targeted Observations”		
2	DLR Falcon	western Europe	FL 310 - 410	IFR
3	SAFIRE Falcon	No participation in “Targeted Observations”		
4	BAE 146	No participation in “Targeted Observations”		
5	DO-128	No participation in “Targeted Observations”		
6	Dimona	No participation in “Targeted Observations”		
7	Zeppelin NT	No participation in “Targeted Observations”		
8	UL Enduro	No participation in “Targeted Observations”		
9	Partenavia P68	No participation in “Targeted Observations”		
10	ATR42	No participation in “Targeted Observations”		

Mission Scenario "Targeted Observations"

with forced convection predicted on next day

Blue Sky --- > Shallow Convection -- > Deep Convection-- > Dis. Convection

07—08--09---10---11---12---13---14---15---16---17---18---19---20---21---22 local



! Mission Scenario "Forced Convection" following on next day !

Scenario “Stratus- Cloud Physics”

Areas and Layers of Operation of Airborne Platforms

Aircraft No.	Aircraft	Area	Flight level (Flight layer)	IFR/VFR Operation
1	Learjet	No participation in “Stratus – Cloud Physics”		
2	G - Falcon	No participation in “Stratus – Cloud Physics”		
3	F - Falcon	No participation in “Stratus – Cloud Physics”		
4	BAE 146	No participation in “Stratus – Cloud Physics”		
5	DO-128	No participation in “Stratus – Cloud Physics”		
6	Dimona	No participation in “Stratus – Cloud Physics”		
7	Zeppelin NT	No participation in “Stratus – Cloud Physics”		
8	UL Enduro	No participation in “Stratus – Cloud Physics”		
9	Partenavia	green	up to FL 120	IFR/VFR
10	ATR42	blue	up to FL 200	IFR/VFR

Mission Scenario "Stratus- Cloud Physics"

----------stratus---------stratus----------stratus----------stratus----------

07—08--09---10---11---12---13---14---15---16---17---18---19---20---21---22 local

Learjet ----------

G-Falcon ----------

F-Falcon ----------

BAE 146 ----------

DO 128 ----------

Zeppelin ----------

Dimona ----------

Enduro ----------

Partenavia ----------slant profiles above Murg valley and AMF----------
----------up to FL 120, below and within stratus ----------

ATR42 ----------slant profiles above SS: V-R-H-AMF and Polirad (triangle)----------
----------up to FL 200, below and within Ac, As, Ns clouds----------

Scenario “City Plume - Lagrange”

Areas and Layers of Operation of Airborne Platforms

Aircraft No.	Aircraft	Area	Flight level (Flight layer)	IFR/VFR Operation
1	Learjet	No participation in “City Plume - Lagrange”		
2	G - Falcon (D-CMET)	No participation in “City Plume - Lagrange”		
3	F - Falcon	No participation in “City Plume - Lagrange”		
4	BAE 146	No participation in “City Plume - Lagrange ”		
5	DO-128 (D-IBUF)	pink	< FL 100	VFR
6	Dimona	pink	< FL 100	VFR
7	Zeppelin NT	Pink	< FL 100	VFR
8	UL Enduro	No participation in “City Plume - Lagrange ”		
9	Partenavia P68	No participation in “City Plume - Lagrange ”		
10	ATR42	No participation in “City Plume - Lagrange ”		

Mission Scenario “City Plume - Lagrange”

*: VFR

-----Blue Sky --------> Shallow Convection --------- >Dis. Convection----------

07—08--09---10---11---12---13---14---15---16---17---18---19---20---21---22 local

Learjet ----------

G-Falcon ----------

F-Falcon ----------

(*)BAE 146----------

(*)DO 128-------Lee Cross Sections (6)-------- Lee Cross Sections (6)----------
--------FL 1000 ft, 3000 ft agl----------FL 1000 ft, 3000 ft agl----------

***Zeppelin**----------Lee Zick-Zack pattern—(long time) ----------
----------FL 1000 ft agl, up to 7 hours duration ----------

***Dimona**----------Lee Cross Sections (3)----------
----------FL 1000 ft, 2000 ft agl ----------

***Enduro** ----------

Partenavia P68----------

ATR42----------